DOCUMENT RESUME

ED 033 899 | 08 | SP 003 269

AUTHOR	Flynn, John M.; And Others
TITLE	An Analysis of the Role of the Teacher in an Innovative Prototype School. Part I. Final Report.
INSTITUTION	Nova Univ., Ft. Lauderdale, Fla.
Spons Agency	Office of Education (DHEW), Washington, D.C.
Bureau No	BR-8-0421
Pub Date	Feb 69
Contract	OEC-0-8-080421-4466(010)
Note	221p.
EDRS Price	EDRS Price MF-$1.00 HC Not Available from EDRS.
Descriptors	*Class Management, Classroom Observation Techniques, *Individualized Instruction, Learning Motivation, Models, School Organization, Simulation, Student Behavior, *Teacher Behavior, *Teacher Role, Teacher Workshops
Identifiers	Flanders System of Interaction Analysis, Multidimensional Analysis of Classroom Interaction

Abstract

Phase 1 has been completed of a five-phase project to develop a model of teacher role behavior in individualized classrooms, to develop teacher training courses (including workshops) for behaviors specified by the role model, and to train teachers (inservice and/or preservice) to fulfill the role provided by the model. The classroom management characteristics of 36 teachers at Nova High School and two Nova elementary schools were studied through a systems analysis approach. The 36-teacher sample was a cross-section of classes ranging in teaching methods from quite conventional to very individualized approaches. An extensive observational instrument was developed to study the teachers' management behaviors and a companion instrument to study the student interaction and queueing patterns. Additional data were collected with the Verbal Interaction Scale (Flanders), the Multidimensional Analysis of Classroom Interaction (Honigman), and through interviews with teachers and staff. Analysis focused primarily on the individualized classrooms with various comparisons being made. A report was also developed on considerations for a computer simulation of the role model to be developed in phase 2; also a prototype training unit was prepared (on external motivation management) so that an inservice training workshop could be implemented in phase 2 for testing. Data collected in phase 1 provides a good base on

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AN ANALYSIS OF THE ROLE OF THE TEACHER IN AN INNOVATIVE PROTOTYPE SCHOOL

PART I

OF II PARTS

John M. Flynn
Clifton B. Chadwick
Abraham S. Fischler

Nova University

Fort Lauderdale, Florida 33314

February 1969

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

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PREFACE

The role of the teacher in the classroom and the changes which the role has been undergoing have received considerable attention in the past few years. That the role is changing has become axiomatic. That new responses are required from the teacher, that new patterns of behavior, new identifications, new methods and approaches to performance are required is a matter of consensus. The imperative for teacher education institutions to investigate and respond to these changes in the teaching role should also be apparent.

Exactly what the new patterns of behavior are can only be determined through systematic research and investigation. In the past the teacher's role has been primarily one of information dispenser--transferring the information which he had acquired to the students. With the rapid growth of knowledge in our society (the so-called knowledge explosion) and with the rapid changes in school organization and administration, changes and advances in curricula, the significant introduction of technological advances, the necessity for analyzing the role of the teacher has become adamant.

Individualized instruction, a rapidly growing concept, may be having the most important effect on the teacher's role. The behavior patterns of the teacher in the individualized classroom are significantly different and yet a thorough understanding of what these changes are has not been realized. The Office of Education's Education for the Seventies Program, (ES'70), has as its basic intention the rapid development and diffusion of new patterns to provide individualized instruction to students. For the successful achievement of this objective one primary need is the determination of the role or various roles of the personnel in the educational environment and the preparation of the prototype training units for these roles.

It is with pleasure and a feeling of excitement that Nova University has undertaken the research project reported herein. Any adequate attempt to develop training units for the classroom personnel of the future must begin with a thorough analysis of the role of the teacher. The best environment in which to do this is one which is already an innovative, individualized environment. The Nova Educational Complex is a magnificent place to begin such a study. The Complex is a new and exciting attempt to individualize instruction for children from Grades One through Twelve, offering an opportunity for each student to move through his educational program at his own pace, receiving individualized feedback on his performance and responding to a technically oriented and intellectually demanding curriculum. The Complex is committed to a philosophy of individualization and is fully aware of the changing demands on its educational personnel.

The analysis undertaken here is intended to be the first in a series of steps leading to the preparation and testing of a series of prototype training units to teach the systems management characteristics and requirements of the teacher's role in the individualized school. This phase has been a significant and stimulating success and should be followed immediately by the proposed subsequent phases.

The issue of redefining the role of the teacher is neither simple nor non-controversial. But it remains one of the most important steps in the development of the new training programs so obviously required for the future of American teachers. The research reported here is work which Nova University is proud to have produced. My special thanks must go to Dr. John M. Flynn, Mr. Clifton B. Chadwick, Miss Diane E. Dogan for performance beyond the call of duty, and to all of the people who contributed to the performance of this research. I am sure that the teacher's role will be more clearly understood as a result of this research.

Abraham S. Fischler
Dean of Graduate Studies
Chairman of Executive Committee
Nova University

ACKNOWLEDGEMENTS

The preparation of this document and the conduct of the research reported herein is the culmination of the efforts and cooperation of many people. The investigators wish to give recognition to a few of the more outstanding contributors.

Participating in the original formulation and development of this project and adding valuable comments and suggestions throughout the conduct of this phase were Dr. Donald T. Tosti, of Westinghouse Learning Corporation, and Dr. Joseph I. Lipson, of Nova University. The quality of their contributions was consistently high and added significantly to the completion of this phase.

This study could not have been undertaken without the extensive cooperation and assistance of The Broward County Board of Public Instruction and the Nova Educational Complex. Mr. Warren G. Smith, Coordinator of the Complex and Mr. William T. McFatter, Superintendent of Schools, provided the project with space in which to work and extensive details about the operation of the Complex and helped create an atmosphere of cooperation in which the teaching staff felt no threat from constant scrutiny. The Nova Supervisors: Messrs Alfred V. Rapp, W. O. Viens, Lawrence Wantuck, John Clark and Robert Vignola also devoted considerable time to answering questions and discussing various theoretical and practical issues.

The Faculty Advisory Committee for the project: Dr. Judith Steward, Dr. Robert Jones, Dr. William Love, of Nova University, and Dr. Will Nelson of the Broward County Board of Public Instruction, offered significant guidance throughout the project.

The Executive Committee: Dr. Abraham S. Fischler, Dr. Donald T. Tosti, Dr. Arthur Wolfe, Dr. Robert Jones, Dr. Marshall Frinks, Dr. Harry F. McComb, Mr. William T. McFatter, Mr. Warren G. Smith, and Dr. Arleigh Templeton took the responsibility for overseeing the project with grace and dignity.

Valuable inputs to the report were made by several people. The extensive data analyses could not have been completed without the extensive efforts of Michael Yost, Earl Hughes and

Corrie Van Veldhuisen. The chapter on the contingency management system was aided by the valuable inputs of Anita Metz. The chapter on Simulation was originally drafted by John Ball and his efforts became the general framework for the final draft.

The development of the functional observation instruments, RO_1 and RO_2 was admirably directed by Diane E. Dogan with Carol Corriveau, Margaret Damveld, Susan Brassard, Natalie Fierro and James MacDougall. The quality of their efforts was a significant factor in the successful compilation of project data. Dr. Fred Honigman contributed insightful criticism and support in the development of these instruments.

The teachers in the Nova Complex and particularly those in the major samples deserve special credit for allowing project staff members to invade their classrooms with exotic radio equipment, video-tape recorders, stop watches and paraphernalia. Their collective ability to keep their cool was a credit to their professionalism.

John M. Flynn
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Fort Lauderdale, Florida

February 15, 1969

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SUMMARY

The work described in this report constitutes Phase I of a planned five-phase project. Phase I was undertaken by Nova University with subcontracts to Westinghouse Learning Corporation (Behavioral Systems Division) and National Educational Associates for Research and Developement(NEARAD). The purposes of the overall project are to develop a model of teacher role behavior in iindividualized classrooms, to develop teacher training courses (including workshops) for behaviors specified by the role model, and finally, to train teachers (inservice and/or preservice) to fulfill the role provided by the model. Phase I of this project involved extensive observational data collection on the behaviors currently exhibited by the teachers in the Nova School Complex (Fort Lauderdale, Florida) to use as a base from which to develop the model and from which to measure change brought about by the future training programs. As currently conceived, Phase II of the project will involve the development of the role model and of the course specifications; Phase III will be the actual development of the courses; Phase IV will be the implementation of the training progams; and Phase V will consist of an evaluation of the success of the training programs.

In Phase I, the classroom management characteristics of teachers at Nova High School and the two Nova Elementary Schools in a cross-section of classes were studied through a systems analytic approach. The study was descriptive in nature.

Data collected during Phase I were primarily gathered through the systematic observation of teachers in the classroom. An extensive observational instrument, RO_1, was developed to study the teacher's management behaviors. A companion instrument, the RO_2, was developed primarily to study the student interaction and queueing patterns in the classroom. Additional data were collected with two stylistic instruments - the Verbal Interaction Scale (Flanders) and the Multidimensional Analysis of Classroom Interaction (Honigman). Informally, data were collected through interviews with teachers and staff and three teachers were commissioned to keep daily diaries.

The Nova schools ranges in teaching methods from quite conventional approaches to very individualized approaches. The principal mechanism for individualization is the Learning Acticity Package (LAP) which adapts the learning process to individualized differences through self-pacing and student decision points. A sample of 36 teachers was studied and includes teachers who utilize LAPs, teachers who teach the entire class simultaneously, teachers who tend to teach individually without LAPs, and teachers who use various combinations of these approaches.

The analyses focus primarily on the individualized classrooms (particularly the LAP classrooms). Various comparisons were made across instructional divisions, across teacher situations, between individual teachers, and between two observations on the same teacher. The general picture which emerges of the LAP teacher is one of a person who spends much of his time on subject matter concerns but who also spends large blocks of time performing tasks peripherally related to subject matter acquisition. For example, the average LAP teacher spends 36% of his time in tasks related to aspects of the educational system which do not directly involve subject matter (e.g., directing students, cleaning equipment, getting supplies, etc.). Individual teachers spend from 4% to 59% of their time on such tasks. A relatively comprehensive list of behavioral characteristics of the average LAP teacher was compiled.

In addition to the descriptive aspects of Phase I, this report also contains a report on considerations for a computer simulation of the role model to be developed in Phase II. After the development of the basic model in Phase II, it is planned to begin a simulation of various aspects of the model to aid in its validation. The discussion of simulation covers probable input and output variables of the simulation effort and problems anticipated in such an effort.

Also, a prototype training unit was prepared in order that an inservice training workshop could be implemented during Phase II to study the problems, constraints, and implementation design prior to the final development of the training packages in Phase III. The unit, which is an external motivation management (Contingency Management), is not intended to be a final training unit, but was designed to be used in a trial inservice workshop. The implementation of such a workshop during Phase II should permit the detection of possible errors in planning and in design before the errors are incorporated in the final product.

The primary recommendation for the future is to proceed with the development of the role model as previously planned. The data collected during Phase I provide a good base on which the model can be constructed. Many additional inputs, however, are needed to build an adequate model of teacher behavior. These include extensive inputs from the literature of psychology, education, management, and the other behavioral sciences. Also, inputs from experts in individualized instruction and related fields are vital.

Chapter I

RATIONALE AND OVERVIEW

Introduction

In January of 1968, Nova University of Advanced Technology, in conjunction with the Behavior Systems Division of Westinghouse Learning Corporation, and the National Educational Association for Research and Development (NeaRad) submitted a proposal to the Office of Education, Bureau of Research to perform a two-and-one-half-year, three-phase study to extensively analyze the management characteristics of the role of the teacher in the individualized classroom, design and develop prototype training units to teach those management characteristics to teachers and validate the training units on an in-service and a pre-service basis.

This proposal was based on five general premises. These are:

1. That the systems management characteristics of the teacher's role in an individualized instruction environment are very important.

2. That these systems management characteristics are amenable to a systematic analysis (task and function analysis) to determine their nature, distribution, and salient features.

3. That these management characteristics can be taught to teachers through the use of careful, systematically prepared in-service and pre-service training courses.

4. That student performance can be predicted in part on the basis of the teacher's management performance.

5. That this analysis and development process would significantly contribute to the frequently discussed topic of teacher staff differentiation.

The three phases of the project, as suggested in the proposal, were:

1. Data gathering and systems analysis.

2. Systematic design and preparation of prototype training units.

3. Field testing (in-service and pre-service) and validation.*

Two separate budgets were submitted: one for the total of the three phases combined, and a separate budget for the first phase--the data gathering and analysis phase.

After extensive review the Office of Education, Bureau of Research, funded the first phase, the data gathering and analysis phase. This phase operated from July 1, 1968, to January 31, 1969. The Contractor was Nova University (Social and Behavioral Sciences Center) with two sub-contracts; one to the National Educational Associates for Research and Development (NeaRad), and one to Westinghouse Learning Corporation, Behavior Systems Division.

The thrust of the proposal as a study of individualized instruction led it to be considered as part of the Bureau of Research's Education System for the Seventies (ES'70) Program. The research is related to the Staff Development section of the ES'70 Program. After funding of the project it was designated as filling Unit 74-75 of the overall ES'70 PERT chart, with the reference number C-00-1.

The report covers the activities of the first phase of Nova's proposal to the Office of Education. This phase has been divided into three activities, the first and largest of which was an extensive descriptive study of the teacher's role (current) in the Nova Education Complex, which is an individualized prototype school system. The second activity was the development of a prototype training unit in motivation management for use in testing the feasibility of project assumptions (particularly Numbers 2 and 3 above.) The third activity was a brief evaluation of the possibilities,

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*In requests for funding future work on this project, proposed phases will probably vary somewhat from those originally suggested.

theoretical and practical, of simulating by a computer, the various functions which teachers perform.

This report is organized primarily around the major activity--the descriptive study. The development of the training unit and the investigation of the feasibility of computer simulation are included as chapters because they influence the conclusions and recommendations.

Problem Statement

The specific problem being attacked in Phase I of this project is the lack of an adequate, thorough descriptive analysis of the management characteristics of the teacher's role in the individualized instruction classroom. This problem can be thought of as a sub-set of a broader problem--inadequate research and development in the area of teacher training for individualized instruction which is a sub-set of a still broader problem--the general inadequacy of teacher training. These general problems are the impetus for the entire project.

The inadequacy of present teacher training is a matter of wide consensus. In discussions of this inadequacy, requests for reforms in what schools teach, in retraining of teachers, and in teacher's methods are widespread.[1]

Southworth and Heathers have pointed out the failure of teacher training institutions to keep pace with the influx of changes and innovations in our schools. They write,

> "teacher education in most schools of education has been standing pat, despite radical changes being introduced curricula, despite technological developments in instruction, and despite new organization patterns, such as nongrading, team teaching and individually prescribed instruction. The failure of teacher education to keep pace with these new developments has meant that it usually has not been possible to implement fully the innovations that are introduced into the school program, even in heavily funded pilot projects."[2]

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[1]EDUCATION, U.S.A., October 9, 1967 by Rene Maheu; James B. Conant, The Education of American Teachers, New York: McGraw-Hill Book Co., Inc. 1963; John R. Verduin, Jr. Conceptual Models in Teacher Education, Washington, D.C.: AACTE, 1967; Innovation in Education: New Directions for the American School, New York: Committee for Economic Development, 1968.

[2]H. C. Southworth and G. Heathers, Teacher Education for Individualized Instruction: A Model, a draft copy of an outline for a final report, University of Pittsburgh, School of

A similar charge, but one which seems to go beyond just keeping abreast of developments, has been levied by Haskew who has stated, "...a college boasts of its requirements that all teacher candidates must complete 72 hours in general education, but the boasts turn to alibies when the performance of its graduates is tested on the firing line."[3] As implied in this indictment, teacher training institutions either do not or cannot train teachers to successfully perform in the classroom.

Kevin Ryan, of the University of Chicago, also charges that, "...presently teacher education is not adequately preparing the majority of teachers..." and then stresses that, "...the present use of teacher's strengths is inefficient for the schools and stultifying for individual teachers."[4] Thus he extends the blame for the inadequacies of our schools from the teachers colleges into the organization of the schools themselves.

While charges against American teacher training and utilization can be cited ad infinitum, the point is generally widely accepted and little is to be gained from endless quotations. The situation is perhaps best summed up by the following statement prepared by a leading teacher's professional group:

> "The events of the last few years seem to dramatize the need for a new concept of the education profession. In its present state the profession cannot deal adequately with the demands placed upon it...the profession as it is can neither provide the kind and quality of service needed in American schools, nor provide for its own growth and development."[5]

Education and Learning Research and Development Center, Mimeo, June 1, 1968.

[3]Lawrence D. Haskew, "Planning for the Education of Teachers," Journal of Teacher Education, Vol. 17, No. 2, Summer, 1966, p. 259.

[4]Kevin Ryan, "A Plan for a New Type of Professional Teaching Staff," Occasional Papers No. 2, National Commission on Teacher Education and Professional Standards, NEA, Washington, D.C: 1967.

[5]"Remaking the Education Profession," prepared by the Staff of the National Council of Teacher's Educational and Professional Standards, for a meeting of State TEPS chairmen and consultants, Houston, Texas, June 25-28, 1968.

The Changing Role
of the Teacher

In the midst of this feeling of inadequacy of teacher training is a recognition that the role of the teacher is changing, although there is not always agreement upon in what direction the role is changing. Gordon Lee has noted:

> "we have been moving...toward a more modest and a more manageable conception of the teacher's function...the trend is toward focus and concentration and toward a contracted (not necessarily a constricted) view of the individual teacher's role within that school. Indeed, the establishment of less ambiguous, hence more functional priorities for both school and teacher for the latter third of the Twentieth Century may be the most important legacy from the educational discussions of the years since the war."[6] (emphasis added)

The changes in the role of the teacher are finding their sources in an increased complexity of teaching tasks, changes in the instructional process, and introduction of educational innovations, particularly in the area of technology. It is obviously necessary to sensitize teachers to innovations and this need has led Louis Bright, former Associate Commissioner of Education, to suggest that a highly pressing need for teacher-education programs is for instruction dealing with the role of the teacher in context of educational innovations.[7] This advancing effect of technology has further led to the conclusion that "a highly useful research area for further

> development is the future role of the teacher in the individualized classroom. It is important to begin determining what the teacher's role will be and what implications the role will have for teacher training and school administration. The determination of this new role is particularly important in defining what colleges of education should do to modify, redevelop and change their course offerings, methods of teaching, course requirements, and attitudes toward the teacher."[8]

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[6]Gordon C. Lee, "The Changing Role of the Teacher," The Changing American School, Part II NSSE 65th Yearbook, University of Chicago Press, 1966, pp. 30-31.

[7]"For the Record," The Journal of Teacher Education, Volume 18, No. 1, Spring, 1967, pp.109-116.

[8]Clifton B. Chadwick, Donald T. Tosti, D. Scott Bell, "Instructional Management: A Defined Role for the Teacher," NSPI Journal, Volume 7, No. 2, February, 1968, p. 5.

One important aspect of the change of the teacher's role has been the increased amount of duties which has been placed upon the teacher. This increase in the amount of effort required from the teacher is reflected in statements such as, "the job of the teacher has become unmanageable...no single individual has the competence, energy, and time to deal effectively with all the responsibilities assigned to one teacher."[9]

> Further, Dorothy Myer has noted, "though having majored in academic disciplines as undergraduates and having pursued graduate work, today's teachers must spend hours doing tasks which do not require professional competence or responsibility. Teachers are required to spend valuable time--time which could be used for instructional purposes--collecting milk money and insurance money, monitoring lunchrooms and lavatories, patrolling the hallways, checking the arrival and departure of school busses, to say nothing of doing an endless amount of clerical work daily; copying records from one card to another, alphabetizing endless record and attendance cards, cutting stencils, cranking ditto machines, arranging bulletin boards and display cases--all of these take valuable instructional time from the youngsters."[10]

This increase in the diversity of the teacher's job has also led to the conclusions that the teacher can't do the job well, "The teacher who must remain alert to the developments in his academic field, keep up on innovations in teaching procedures, advise and consult with extracurricular groups, conduct a home room, read and evaluate student work, monitor lunch rooms, collect money or sell tickets for school events, consult with guidance and personnel staff, work on curriculum committees, chaperon school functions, confer with students and parents, attend teacher's meetings, participate in professional association and learned society activities, advise school clubs, supervise student teachers, and keep attendance in academic records, while teaching for a full day <u>does not have time to do all of his jobs well</u>."[11] (emphasis added)

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[9]National Education Association, National Commission on Teacher Education and Professional Standards, <u>Prospectus</u> (for the year of the Non-conference,) Washington, D.C: The National Education Association, 1966, p. 1.

[10]Dorothy V. Myer, "Testimony on Behalf of the National Commission on Teacher's Education and Professional Standards, National Education Association." Before the Sub-committee on Education, of the Senate Committee on Labor and Public Welfare, Thursday, August 10, 1967.

[11]Roy Edelfelt, "The Teacher and His Staff," <u>NJEA Review</u>, February, 1967, p. 15.

The significant increase in the number of teaching duties seems to require more personnel more carefully deployed to complete the tasks. The general concept of the differentiated staff developed from this need.

Differentiated staffing has been particularly emphasized in the traditional or conventional (non-individualized) school. The approach has, to a considerable extent, been championed by the National Commission on Teacher Education and Professional Standards and requires a leveling structure within the school which allows for different kinds of teaching responsibilities and for different identified education functions and professional needs to be performed by personnel with varying skills and levels of experience.

"fundamental to the differentiated teaching staff...is a ...structure within which both the levels and kinds of teaching responsibility can be assigned and rewarded in keeping with identified educational functions and professional needs"[12]

Staff differentiation has begun to gain wider acceptance and has reduced some of the problems of the growing complexity of the teacher's role. Many schools like the Nova Complex use differentiated staffing patterns with teacher aides and volunteer parents to take care of the housekeeping tasks of the school, in some cases allowing the teachers to devote more time to the students.

Attending to the needs of the students is a pressing concern of teaching and an area where individualized instruction is making significant changes in the requirements placed upon the teacher.

Individualized Instruction and Teacher Training

The advent of individualization in instruction has raised again the necessity of analyzing the role of the teacher. In

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[12]Dwight W. Allen, "A Differentiated Staff: Putting Teaching Talent to Work," The Teacher and His Staff: Occasional Papers, No. 1, NEA (NCTEPS,) 1967; Also see: Dwight W. Allen, "A Differentiated Teaching Staff" (Mimeo) School of Education, Stanford University, March, 1967; Joseph W. Crenshaw, "Differentiated Staffing" (Mimeo) State Department of Education, Florida (no date); Roy Edelfelt, op. cit; Kevin Ryan, op. cit; The Real World of the Beginning Teacher, Report of the 19th National TEPS Conference, New York City, 1965, Washington, D.C., NEA, 1966.

general, individualized instruction is characterized by its use of the individual and his needs as the beginning point in the instructional process and emphasizes evaluation throughout the process. Using a fairly broad definition of individualization, we see that it "consists of planning and conducting with each student a program of studies that is specifically tailored to his learning needs and his characteristics as a learner...individualized instruction requires that we start with the student, not with the group."[13]

Individualized instruction is expected to significantly increase the student's ability to proceed through his educational endeavors. The emphasis on the student as the starting point, planning so that each student may proceed at his own pace through those materials specifically relevant to his needs and objectives, with frequent thorough evaluation of his progress allowing tutoring when he needs special help and rapid advancement when his performance warrants, should significantly improve the student's educational progress. Most individualized approaches feature careful diagnosis and prescription, individual planning and engagement in instructional activities, alternative ways to achieve educational objectives, frequent emphasis on mechanical aids, frequent emphasis on the student taking some personal responsibility for his scheduling, and frequent systematic application of reinforcement principles to shape and maintain students' learning behaviors.

It is generally conceded that individualization of instruction will require changes in the role of the teacher. "Individualized instruction by means of computers and other self-study techniques will certainly require drastic changes in the role of the teacher. His primary job will no longer be that of presenting information and drilling students. He will now devote most of his time to diagnose individual learning problems, remedying them in close tutorial interactions with the pupils, and leading group discussions. He will be required to coordinate the use of many instruction materials and media available to him, deciding which procedures will be most effective for students with different learning needs."[14]

Because of the changes in instruction, ..."many observers note that the teacher is changing, albeit slowly, from a dispenser of facts to an intermediary between learners and learning resources of all kinds. He is becoming a learning

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[13] Glen Heathers, "Teacher Education for Individualized Instruction," talk given at a Conference on Teacher Training for Individually Prescribed Instruction at the Sheraton Hotel, Philadelphia, February 26, 1967.

[14] John E. Coulson, "Automation, Cybernetics, and Education," SP 1964, Systems Development Corporation, March 18, 1965, p. 4.

facilitator. Gradually it can be anticipated that the teacher will not 'teach' subjects such as physics, chemistry, algebra, etc., but will, rather, serve to direct the learner to appropriate learning resources, materials, and computerized information systems and advise and assist him in their most efficient use."[15]

These changes, or the beginning signs of them, can be seen in such programs as the Individually Prescribed Instruction programs (IPI), The Planned Learning in Accordance with Needs Project (PLAN), The Primary Education Project (PEP), and in the Nova Schools.

The move toward individualization is a general and growing trend, as evidenced by related research and the growth of such projects as the ES'70 Project through the Office of Education's Bureau of Research. And it is generally conceded that any systematic approach to the individualization of instruction will have a definite impact on future programs to prepare teachers.[16] Central to teacher education for individualized instruction is development of information about the roles of the teacher in the individualized instruction classroom. "To derive the details of desirable new roles for teachers within these new modes--individualized instruction, small group instruction, and large group instruction--is one major task of research on teaching in the years ahead."[17]

Analysis of Teaching Functions

The beginning point for new teacher education programs is to be found in extensive analyses of technological, sociological and philosophical changes that impose new demands on

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[15]Perry Rosove, The Final Report, Part Two, Appendix E, A Pilot Center for Educational Policy Research, Systems Development Corporation, February, 1968, p. 46.

[16]G. E. Dixon, "Proposal to Develop Educational Specifications for a Comprehensive Teacher Educational Program," University of Toledo, 1967; and H. C. Southworth, "A Model of Teacher Training for the Individualization of Instruction," University of Pittsburgh, October, 1968.

[17]N. L. Gage, "Research on the New Roles of Teachers Required by Educational Innovations," a paper delivered at an international Conference on The Changing Roles of Teachers as Required by Educational Innovations, Berlin, October 16, 19, 1967, Mimeo, pp. 6 and 7.

the school, analysis of new innovative programs and their requirements, and a thorough program to identify the functions, competencies, and qualities that teachers will need to perform their roles in new educational instruction programs. It has been noted that "the model for a teacher education program should be based on a task analysis of teaching and a job analysis of what a teacher should be like in order to perform the teacher's role."[18] Such functional analyses have been suggested by several of the new models for elementary school teacher training programs, particularly those of the University of Pittsburgh, Florida State University, Northwest Regional Education Laboratory and the Ohio Consortium of Universities.

Summary

The teacher's role (which is generally one of the least visible roles in the school, and one which is difficult for outsiders, or even insiders, to observe and evaluate) has been undergoing significant changes with the advent of increasing responsibility placed on the teacher's shoulders and the further advent of new and innovative techniques in instruction, particularly individualized instruction.

The primary problem addressed by this project is the necessity for a thorough descriptive analysis of the management characteristics of the teacher's role in an individualized classroom. This analysis has taken place at the Nova Education Complex, an innovative, individualized, prototype school. This descriptive analysis is intended to be the basis for the development of an extensive model for the role of the teacher in the individualized classroom. In the following section of this Chapter, the purpose of this project is examined at length.

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[18] H. Southworth and G. Heathers, op. cit.

Purpose

As mentioned in the introduction, the total proposed project was to analyze the systems management characteristics of the role of the teacher in the classroom of the future and to develop and test prototype training units for both in-service and pre-service teachers in these systems management characteristics. The Bureau of Research funded the first phase of the proposal which was entitled, "An Analysis of the Teacher's Role in an Innovative Prototype School." This was the first of three phases proposed. To understand fully the work completed in this phase of the project, it is necessary to relate it to the overall design as outlined in the proposal.

This project was primarily conceived of as an application of systems analysis techniques to the explication of the functions of the teacher in the individualized classroom with emphasis on the techniques which could be used to manage the instructional environment. The basic position was taken that "...the fundamental reason for an education system is to manage learning so that it will occur most efficiently." (emphasis added)[19] The general plan of the project followed the concepts of the systems approach beginning with an extensive descriptive analysis of the current role of the teacher in an individualized school, followed by a systems design activity, laboratory simulation, and the development of prototype training units. These activities are to be followed by testing and validatation activities. The expected outcome of this total project is a group of in-service and pre-service training courses designed to teach the current or prospective teacher to more effectively manage the conditions of the individualized classroom. Figure 1-1 shows the relation of these activities. The original concept of a three phase project is discussed below in terms of five phases. The activities remain essentially the same as in the original proposal, but have been divided in order to make each phase more homogeneous and discrete.

Systems Analysis

Starting with the existing teacher system, the first effort of the project is to attempt to identify relevant information about the system; to try to make explicit in as much detail as necessary, the basic conditions influencing the operation of the system and its output. The way in which this activity was performed in the teacher role project is reported in a section, on Page 15.

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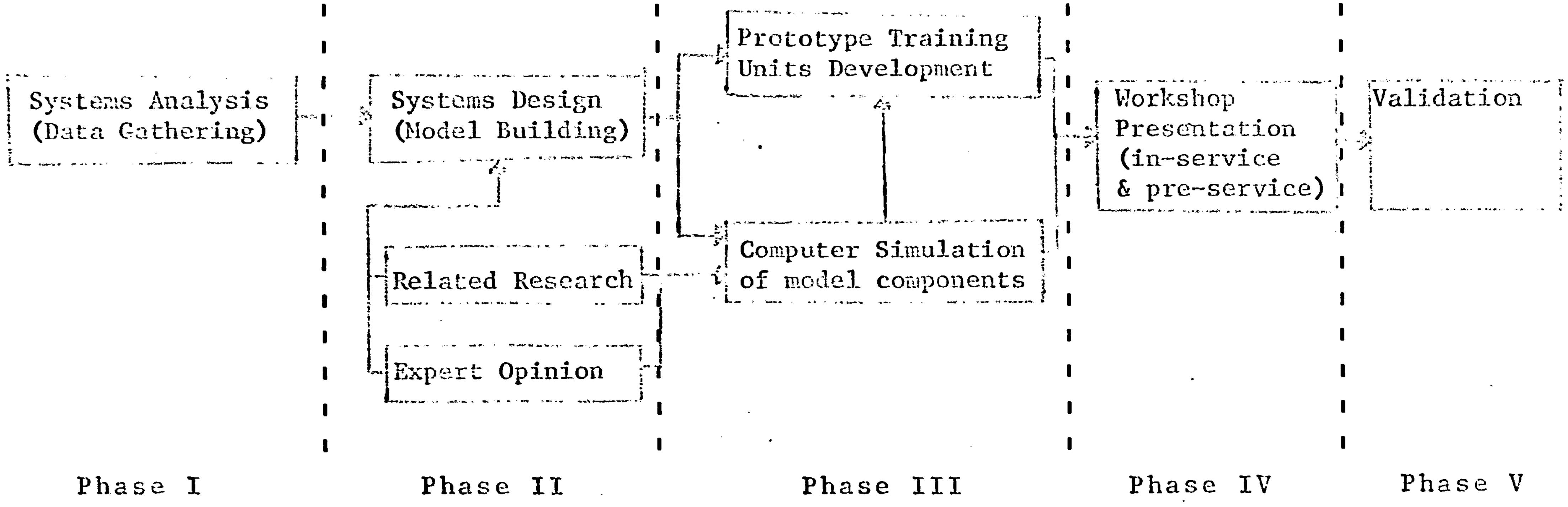
[19] Robert Gagne, The Conditions of Learning, New York: Holt, Rinehart & Winston, 1965.



The Five Phases of the Project

Figure 1-1

System Design

Following the analysis of the systems is the activity of creating modifications in the system or developing new designs for the system. This activity is based upon the analysis, but also requires extensive input from available research efforts bearing on the management characteristics of teaching, from theories about teaching (particularly individualized teaching theories,) from expert opinion, etc. The purpose of the design is to optimize the operating characteristics of the system and requires the establishment in the design phase of criteria for optimization.

Laboratory Simulation

Systematic exploratory research and simulation of the design will be engaged in to determine the effects of various design variables. Confirmation of design features through trial and error studies and simulation would be expected to confirm or reject salient features of the design. A general discussion of the plans for this activity may be found in Chapter Five.

Development of Prototype Training Units

Following the guidelines and specifications established in the design and simulation activities, prototype training units to teach the management characteristics of the teacher's role will be developed. This effort is expected to involve the location of relevant materials, preparation of new materials, examination of various modes of presentation, development of testing devices, etc.

Testing

The next activity of the project requires that the materials that have been developed in accordance with the systems design and its related research and simulation must be given a full scale test. This process involves presenting the instructional activities (materials, simulations, tests, etc.) to teachers on both a pre-service and in-service basis, and evaluating their cognitive and affective performance on the training courses.

Validation

To ascertain whether the product of all of these efforts has succeeded, the researchers must follow the newly trained teachers (both pre-service and in-service) into the classroom and evaluate their performance. This evaluation is on two levels: (a) do the teachers perform on the basis of the skills which they were taught; and (b) does the performance of these skills achieve the objectives established, i.e., is the classroom better managed, and does it achieve some form of optimization in relation to the criterion for optimization established in Phase Two, Systems Design Section.

Summary

This entire five-phase process can be thought of as a systems study, whose output is a new or alternative systems design, with materials and processes to bring about the new design. The basic nature of this type of study is to ascertain the basic properties of the teaching system and from those properties to modify, redesign, predict, and control the properties involved in the future operation of the system.[20]

[20] This general design is consistent with the suggestions for use of the systems approach in education in a paper entitled, "The Eight Steps of the Systems Cycle," by Henry Lehman, Felix Kopstein, Leighton Davis, David Bushnell, and Donald Crowley, as cited in Proceedings of Project Aristotle Symposium, December 6 and 7, 1967, pp. 181-189.

Methodology

It is inappropriate in terms of this study to speak of a research design per se. A systems analysis approach is used which requires following a set of sequences or steps. This general approach has been adopted for use in the entire project and the particular aspect of research which this report concludes (Phase I) follows the same pattern of a descriptive nature.

Since the general approach used in this project is the systems approach, it will be defined in detail. The systems approach, in general, is "...the idea of viewing of a problem or situation in its entirety with all of its ramifications with all its interior interactions, with all its exterior connections and with full cognizance of its place in its context."[21] The systems approach in individualized instruction is one which views "...the individual and his needs as the basic unit of the system and emphasizes evaluation at all stages of the educational process. Objectives must be defined, input and output of the system have to be accurately measured and all relevant conditions described and defined."[22] As suggested by these excerpts, a systems approach to individualized instruction requires considering the larger process of education, rather than focussing only on a small problem isolated from its actual environment.

The systems approach has taken a position of prominence in the technological society of the United States. The approach has been referred to as "common sense refined" and its applicability in education is now generally accepted. The systems approach in education has been described by Ullmer; "...the conceptual structure that forms the basis for the field of instructional technology is the contention that instruction is a process that can be approached in a systematic or technological manner, in which the numerous parameters relevant to the efficiency of instruction can be identified, analyzed and manipulated toward the end of prescribing optimum conditions for learning based on and validated by scientific inquiry and measurement."[23]

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[21]A. W. Mood, "Some Problems Inherent in the Development of a Systems Approach to Instruction," unpublished paper prepared for a Conference on New Dimensions for Research in Educational Media implied by the Systems Approach to Instruction, Center for Instructional Communications, Syracuse University, April 2, 1964.

[22]John C. Flanagan, "Functional Education for the 70's," Phi Delta Kappan, 49:28, September, 1967, p. 28.

[23]Eldon J. Ullmer, "The Meaning of Instructional Technology: An Operational Analysis," Educational Technology, December 15, 1968.

The application of the systems approach places some requirements on the educational process. The first of these requirements is one which has become a cliche in the verbal repertoire of the educational world--the necessity for clearly defined objectives. (The fact that the recognition of this requirement has become a cliche does not obviate the necessity for the requirement itself.) There definitely is a necessity for clearly defined objectives in the educational process and there continues to be a great deal of trouble in defining educational objectives for most systems, basically because of an incomplete understanding of the products which the school system is responsible for developing. Recognition of rapid change rates in our society has led to the use of hueristic goals which may be able to lead to adoptive solutions.

In school systems the extensive commitment of time and money requires that the educational tasks (the educational process) particularly the individualized instruction process be thoroughly defined so that it can be divided and sub-divided into its component parts. Organized knowledge of education and psychology and technological equipment related to the educational process can be brought to bear on the component parts of the individualized process only if the objectives of the system are clearly defined. This definition of objectives generally leads to division and sub-division of the process or task involved into its component parts.

The sub-division of the tasks required in the individualized instruction process into units then leads to the second requirement--specialization of personnel functions. This requirement should be evident because organized knowledge cannot be brought to bear on a unit or component unless the personnel involved possess the required knowledge. Further, it is not possible to say what the required knowledge is until each of the functions has been divided and analyzed. This specialization then requires the ability to organize and employ information, techniques, strategies, criteria, etc., and an ability to react intuitively on relevant experience to emergent educational situations.

The third requirement of the systems approach, concomitent with the specialization of personnel, is a new and sophisticated organization pattern that brings the specialists and their components together in a unified whole or system. In the past, school organization has not been faced with the degree of complexity with which many industrial organizations have been faced, but the individualization environment which is now developing will require a significantly increased complexity of organization. A need for careful organization will flow logically from the increased sub-division and specialization of the education process. Beginning efforts toward this specialization can be seen in the differentiated staff efforts.

The fourth requirement of the systems approach, then, is a systematic and intensive analysis. The specialization that is needed in individualized instruction can be brought about only after a careful analysis of the teaching tasks, the teaching environment, and the role of the teacher. Some specialization has occurred in all schools in the division of tasks. This is particularly true in relation to subject matter areas where the teachers specialize on the basis of a subject. Also, schools frequently have divisions on the basis of administrative systems and the instructional system. As Southworth and Heathers have pointed out, "the model for a teacher education program should be based on a task analysis of teaching and a job analysis of what a teacher should be like, in order to perform the teacher's role. Unfortunately, one cannot derive these bases for a model from examining any of today's instructional programs, since no current programs meet all the requirements for a school...instead one must rely on the literature, on study of certain advanced instructional programs, and on rational analysis." (emphasis added)[24]

One of the purposes of the overall project is to develop models such as Southworth and Heathers discuss and the part os the project covered by the report is an identification or systems analysis phase entitled, "An Analysis of the Role of the Teacher in an Innovative Prototype School." The primary function of this phase has been to gather extensive descriptive data on what is considered "certain advanced instructional programs" and to thoroughly analyze the general characteristics of the teacher's role with specific emphasis on those aspects which are important to the management of the individualized instructional environment.

Starting with the existing teaching system, the first effort of the project has been to identify in as much detail as possible, the relevant information about the teacher's and the system's objectives, the inputs to the system and to the teacher that influence their operation, the basic elements, components and functions of the teaching system, the modes of operation and interaction of these elements, the decision points in the flow of information through the system, the controls that are exercised upon the teacher's operation, the end products of the teacher's functioning and their relation to the system objectives, etc.

This is an operational description of the system. It involves ascertaining the objectives of the basic system and of the teaching system, the functions and activities performed, the characteristics of the performers of those functions and

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[24] H. C. Southworth and G. Heathers, Op. cit., p. 50.

activities, the logical situations involved as the functions are performed, and the records of information that were available in different phases of the system's operation.

Thus, the basic effort of this phase has been to make explicit, in as much detail as possible, the salient conditions constituting the operation of the system through extensive data gathering on the operation of the Nova School System. The description attempts to cover all of the teacher's current role in the individualized classroom. Information has been gathered on interactions of the teachers with the students, administrators, and learning materials, short of the invasion of privacy. The teacher has been viewed as part of a behavior system (the school), and analysis has included the handling of all input, processing, recording monitoring, and output functions of the teacher within the system.

The System and Its Definitions

The specific system under study is the teaching system. To define this system was one of the first tasks of the project. In general, the definition of a system is that it is any identifiable assemblage of elements (objects, persons, activities, component parts, information records, etc.) which is interrelated by process or structure and which is presumed to function as an organizational entity and generating an observable (or sometimes merely inferable) output or product.[25]

For the activities of this phase of the project a group of definitions, forming a hierarchy, has been prepared. Each level in the hierarchy is composed of units which, when combined, comprise the level above it. Each unit can also be sub-divided, these divisions forming the level below it. Figure 1-2 shows the relationship of levels.

Level One: The System

As pointed out previously, the system being studied is the school system; specifically the Nova Education Complex of the Broward County School System.

Level Two: The Sub-system

The specific sub-system being studied in this project is the teaching system, that assemblage of interrelated activities currently performed by, or directly related to, the

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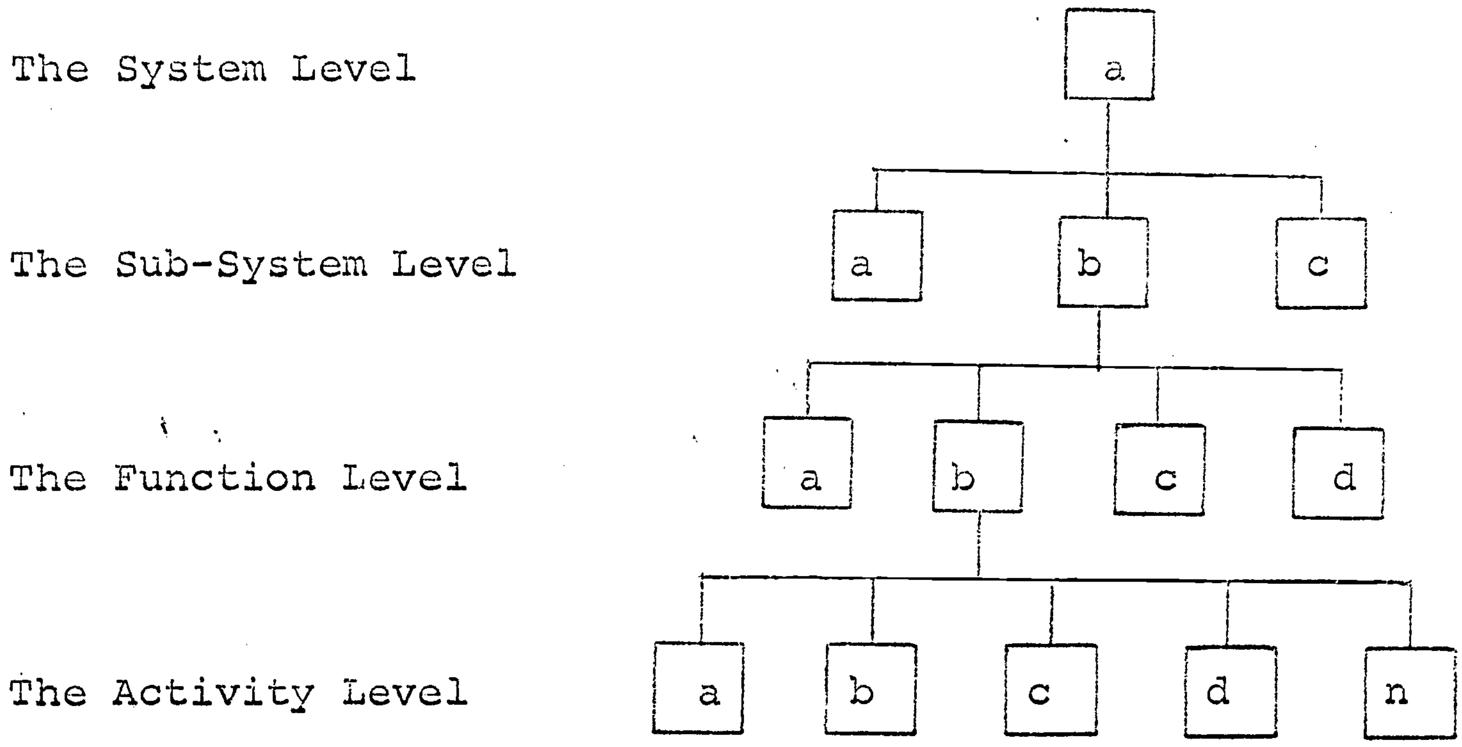
[25] David G. Ryans, "Systems Analysis in Educational Planning," SDC TM-1968, July 9, 1964.



The Relationship of Units within the System

Figure 1-2

teacher and designated as the teaching system. During this study the investigators have been sensitive to the fact that there may be a high degree of variance between what *is* performed by the teacher and what *should* be performed by the teacher. In future phases attempts will be made to define the teacher's system in terms of a model of individualized instructional management, which would then have its own distinct characteristics. The current phase is first a description of the existing, identifiable assemblage of elements and then an analysis of their interrelations. This phase has attempted to deal strictly with teacher functions, those things currently done by the teacher or related personnel, focusing primarily on the process of the teaching system with some attention to its input and output.

The teaching system is treated as a process which is a series of actions, operations, and motions involved in the accomplishment of an output. In this case, the process is comprised of the *functions* and *activities* performed by the teacher. The term process is used to denote progress from a definite beginning to a definite end, and implies that something is produced or some change in behavior is brought about. The term requires a sub-division of the entire series of operations into steps or stages. Through this sub-division the organized knowledge of education may be brought to bear on the performance unit in question, the teacher. It is generally accepted that systems are component designed, i.e., that the system consists of sub-units each being a component of the larger system. Each component of the system is a system and can therefore be evaluated and developed in its own sense, and it also can have sub-components to the point of reduction where it is no longer practical.

The process portion of the system is that part where changes are made in the input to achieve the output, and is related to the concept of the intervening variable (IV). The concepts are shown here in relation to experimental concepts from educational and learning research:

A.	input	process	output
B.	antecedent conditions	intervening variable(s)	consequent event
C.	independent variables (e.g. teacher)	intervening variables (e.g. pupil or process)	dependent variables (e.g. pupil achievement)[26]

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[26] B. O. Smith, "A Concept of Teaching," *Teacher's College Record*, 1960, 61, p. 234.

Function

The act of systems analysis or design inevitably is involved in the determination of what are the functions of the system and how the units in a system contribute to the functions of the system.

A function is a general unit that must be accomplished within or by the system. It is the purpose of any performance system and is the contribution which an activity or group of activities within the system makes to the whole.[27]

When personnel are involved function is a group of behavirs which are organized to perform a certain type of purpose or duty. For this study a function is a unit of the instructional process and the combination of the functions, (i.e., the process) is assumed to account for the product or output. Often the process aspects are easier to delineate than the product aspects. Functions are thought of as duty--as doing things--and make up the process aspects of the system. The total of the functions of the teacher system (or of an instructional management system) should define the role of the teacher in the system. This project attempts to isolate functions in relation to process variables. Examples of functions are diagnosing, prescribing, and presenting information.

One note of importance should be mentioned. A general discrimination is made between manifest and latent functions. In general, systems analysis attempts to make all functions manifest; that is, it attempts to have them performed as "intended and recognized" by the designer.[28] Latent functions are presumably omitted from the system. But in a study of a system as delicate and uncharted (despite huge amount of research) as the teacher system the researcher must be constantly aware of the high probability of the importance of latent functions and must search for these latent functions in an effort to make them manifest.

Activity

An activity is a work effort involving time and resources required to complete a task or job which is a portion of, or

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[27]Harold Fallding, "Functional Analysis in Sociology," American Sociological Review, XXVIII, No. 1 (February 1963).

[28]Robert K. Merton, "Manifest and Latent Functions," Social Theory and Social Structure, rev. ed., New York: Free Press of Glencoe, Inc., 1957, p. 51.

contributes to a function. It is an operation, a mechanism, or a constraint, which leads to an achievement of the function.

Sequences

A function sequence is a representation of functions as they occur in relation to each other over time.

An activity sequence is a representation of activities as they occur in relation to each other over time.

The purpose of the activities in this phase is to identify as many as possible of the teacher's managerial functions, identify the activities comprising these functions, relate them in sequences, and study the frequency with which they, and many other events and activities in which the teacher engages, occur. The definitions and the hierarchy in which they have been placed have been designed to allow for maximum logical systematic organization of the information gathered in this phase of the project.

A Description of the
Nova Complex

The Nova Complex is comprised of three units, the Nova High School, Nova I Elementary and Nova II Elementary. The Nova High School and Nova I Elementary School are part of the South Florida Educational Center located west of Fort Lauderdale at Forman Field. The Center was created jointly by the Broward County Board of Public Instruction and a group of business and professional people from the County. Nova II Elementary, the third unit of the Nova Education Complex is conceptually part of the Center, but is located in the old Fort Lauderdale High School building on Southeast Third Avenue near downtown Fort Lauderdale. It will move to a new building at Forman Field for the 1969-70 school year. Nova I and Nova II Elementary Schools have approximately 1,400 students, and the Nova High School has approximately 3,000 students, all on continuous progress education programs.

The long range goal of the South Florida Education Center is to provide an opportunity for Broward County children to receive a superior education from Kindergarten through the Doctoral level on the same campus. South Florida Education Center consists of the Nova schools, the Broward Junior College, the main campus of Nova University and an Agricultural Research Center of the University of Florida. Nova University has at present completed two of their buildings and three residential halls. This institution will play a progressively more important role in the future successes of the Nova schools.

The Nova Educational Complex is a tax supported Broward County school system financed by local, State, and Federal tax funds, in cooperation with various educational institutions and foundations. The entire capital outlay and operational cost for the Complex are borne by the Broward County Board of Public Instruction District. Details on the history and construction of the Nova Educational Complex can be found in Appendix A.

Prior to the opening of the Nova High School in 1962, the Planning Committee spent many hours of study and miles of travel in preparing the educational specifications for the Nova High School which were published in 1962. At about the same time that Nova High School was built, the Broward County Junior College, already in existence at another location, moved to new buildings constructed at the South Florida Center.

In 1965 Nova I Elementary School was opened just east of the High School Complex. This school is also part of the public school system and is dedicated to the same philosophy as the Nova High School. The Nova schools have one single sequence, a continuous progress philosophy from Kindergarten through the Twelfth Grade. The second Nova Elementary School, Nova II, opened in the Fall of the 1966-67 school year, using the facilities of the old Fort Lauderdale High School. The attempt to implement the philosophy of the Nova Schools in a condemned high school building has led to the belief that such an attempt could also be made in any other school facility in the Country. The teachers at Nova II accepted the challenge without complaint, and provided at that school an education considered equal to that of Nova I with its modern facilities.

The philosophy of the Nova Educational Complex emphasizes individualization of education, learner sensitive education and students' ability to progress at their own rate through a series of concepts. After the High School was opened and operating, several of the departments began making attempts to comply with the philosophy. The 1963-64 school year was the important year with the Departments of Math, Science, and Technical Science, devising means to allow students to move independently. During the latter part of the 66-67 school year, modular scheduling as developed at Stanford University was introduced into the school system. Also, during that year the curriculum leaders at Nova High School developed a model of a systemized individualized learning package. This module is called, "The Learning Activities Package." The modular scheduling and the learning activities package were essential to the development of the individualized instruction at Nova. Also, during this period the Nova High School was invited to become part of the ES'70 network of schools. Details of the development of the Learning Activities Package are found in Appendix A.

Philosophy

The aim of the Nova High School is to develop a mature adult who willingly accepts his civic and social responsibilities in a democratic society, possesses a sound foundation for the attainment of occupational competence, thinks critically and creatively, communicates effectively, and regards education as a life-long process.

Nova places major emphasis on hard-core curriculum. Its chief concerns are in the areas of communication, mathematics, pure and applied science, humanities and social studies. However, it is recognized that, while mastery in these areas is important in itself, the educative process demands more from the teacher than mere formal presentation of the material. What a student is learning at any given time is determined by his past experiences, by his present interests, needs, and capabilities, and by the kind and quality of the interaction which takes place between the student and his environment during the learning process. Therefore, to effectively attain the school's general objectives, the learning situation must be structured to establish a continuity between what is to be learned and what has been learned; to provide opportunities for the fruitful interaction--intellectual and sensorial--between the student and the subject he is studying, his peers, and his teachers; and to foster a set of desirable attitudes toward the subjects. The collateral learning of enduring attitudes will be in the long run as important in the student's development as the intellectual content of what he learns. To this end, parents, teachers, and students must assume new responsibilities. Further information on the philosophy and the following objectives may be found in Appendix A.

Objectives

1. To develop and demonstrate a quality of education which will be a prototype for Broward County, the State and the Nation.

2. To use new concepts of time studies as they relate to programming, length of a school day and calendar term.

3. To utilize space as it relates to economy, function, programming, efficiency and design.

4. To provide consultants, other than teachers, who will be available to assist and advise the Faculty.

5. To encourage the professional staff to invite and schedule highly qualified local persons to serve as visiting instructors.

6. To utilize fully the talents and time of instructors by providing aides and clerical assistants.

7. To maintain an effective guidance and counseling service.

8. To conduct a comprehensive program of educational experimentation including action projects.

9. To provide an environment which will allow maximum development of mental and physical health.

10. To provide an intellectually challenging curriculum which will develop the academic interests and talents of every student.

11. To provide a curriculum which will allow each student to assume major responsibility for his own learning.

12. To develop the student's understanding of the rights and responsibilities of democratic government by according him the privilege of sharing with the Faculty in the planning of school program and policy.

13. To correlate subject areas in a meaningful pattern that will involve the student in a learning situation which precludes the complete isolation of different experiences.

14. To implement a schedule sufficiently flexible for students to pursue the greatest number of academic interests.

15. To provide a curriculum which will allow each student to progress at a rate and to a depth consistent with his abilities.

16. To develop critical thinking by presenting students with problem situations which require their use of pertinent information and analysis toward a conclusion based on the data available and their own critical examination of them.

17. To provide for individual differences of students by grouping them according to their rate of progress and achievement, and to accord all students the privilege of working on their own.

18. To structure units of learning so that students may progress with minimum explanation from the teacher.

19. To make available to students and to encourage their use of a wide range of learning resources.

20. To make the best possible use of each teacher's unique talents and interests.

21. To provide ample resources and opportunities for individual teacher growth and professional development.

22. To provide teachers sufficient time out of class for course planning, further study, and interdepartmental and professional meetings.

23. To improve the instructional program by utilizing teachers in those areas in which they are best qualified, and by teaming teachers whenever this proves feasible and beneficial to the course of study.

The Nova Educational Complex is a developmental research center and the materials, curriculum, organization, etc., are considered to be innovative, prototype and experimental in nature. There is no intention to express inherent rightness in anything being done in the Complex, but there is a definite emphasis on a research basis. The Complex may have had as many failures as successes, but in the long run the failures are as valuable and as important as the successes.

Teaching Staff

Team teaching has been organized at Nova Educational Complex and is used in many areas. These teams may consist of two members or up to six or seven members, depending on their responsiblities. Each team has a leader. Each instructional program has a curriculum supervisor who is responsible for it, allowing full-time leadership of the important curricular areas. The instructional teams are made up of different types of personnel, such as teachers, teacher's aides, assistant teachers, and technicians. Each department in the High School has two teacher's aides who do clerical work in addition to some helping in the classroom. These people relieve the teacher of some of the detail work that prevents a teacher from teaching. Several of the departments elected to "give up" a teacher in order to have additional teacher aides in the classrooms. This becomes possible because of the open lab, or classroom type of instruction and the team setup.

Guidance is considered very important in this type of curriculum. The Nova High School has six guidance counselors, or one counselor for each 500 students. As the School continues to individualize, guidance by the specially trained counselors and guidance by team leaders and team members becomes more and more important.

Sample and Procedures

Two basic samples of teachers were used for observational data collection in the project. The first sample was made up of those teachers observed with the RO_1-RO_2 data collection forms (see Chapter Two for description). The second sample was made up of teachers observed with the Modified Verbal Interaction Scale (see Chapter Two).

Elementary teachers from Nova I and Nova II were chosen for the RO_1-RO_2 observations on a random basis from the two schools. Ten teachers were chosen from Nova II and twelve from Nova 1. One resident observer was assigned to Nova I and another to Nova II. The teachers chosen for observation on the Verbal Interaction Scale were also randomly selected. Eight teachers were chosen from Nova I and ten from Nova II. Some overlap between RO_1-RO_2 and VIS samples occurred.

High school teachers for both the RO_1-RO_2 and VIS samples were chosen at random from the eight department in the High School. Because the study focuses on the managerial aspects of teaching the Physical Education Department was excluded. Two RO_1-RO_2 observers were for the High School and were assigned to every other teacher in the sample and required to schedule at least two hours of observation each day.

In all presentations of data regarding the teachers in the sample, care has been exercised to delete as many identifying attributes as possible in order to ensure anonimity for the teachers. In some situations, information regarding departments or schools, age, and sex has been retained where it is necessary to the discussion. However, even in these cases, it is unlikely that specific individuals can be identified.

A summary of the characteristics of the teachers of the Nova Educational Complex is shown in Tables 1-1 through 1-4. In Tables 1-1, 1-2, 1-3 the certification information on the teachers is shown. Ranks are: (1) Doctorate, (2) Master's Degree, (3) Bachelor's Degree, (4) No Degree. The various types of certificates are shown in each table. While some information is missing the data show only one non-degree holding teacher in the schools and this teacher was not included in the project's sample.

Advanced degrees, all Master's Degrees, are held by 26% of Nova I Faculty, 14% of Nova II Faculty and 30% of Nova High School. In the main (RO_1-RO_2) sample for this study none of the Nova I teachers had Master's Degrees, 50% of the Nova II teachers had Master's Degrees and 28% of the Nova High teachers had Master's Degrees. In the VIS sample, 20% of the Nova II teachers, none of the Nova I, and 11% of the High School teachers had Master's Degrees.

The age information for the total High School and the samples is presented in Table 1-4.

The following chapter details the instrumentation which was used on this project.

	RANK 2			RANK 3			MISSING		
	T*	R**	V***	T	R	V	T	R	V
02 Advanced Post Graduate	11	2	2	0	0	0	2	0	0
03 Provisional Post Graduate	1	1	1	0	0	0	2	0	0
04 Graduate	0	0	0	12	2	3	0	0	0
09 Temporary	0	0	0	3	1	1	0	0	0
Missing	1	0	0	4	2	1	0	1	0
TOTALS	13	3	3	19	4	4	2	1	0

Table 1-1

Teachers by Certificate Rank and Type

NOVA I

*T= Total teachers in school
**R= Teachers in RO_1 & RO_2 sample
***V= Teachers in VIS sample

	RANK 2			RANK 3			RANK 4			Missing		
	T*	R***	V***	T	R	V	T	R	V	T	R	V
02 Advanced Post Graduate	10	1	2	0	0	0	0	0	0	0	0	0
04 Graduate	1	0	0	20	1	6	0	0	0	0	0	0
09 Temporary	0	0	0	1	0	0	0	0	0	0	0	0
25 Substitute	0	0	0	0	0	0	1	1	0	0	0	0
Missing	1	0	1	2	0	0	0	0	0	0	1	1
TOTALS	12	1	3	23	1	6	1	1	0	0	1	1

Table 1-2

Teachers by Certificate Rank and Type

NOVA II

*T= Total teachers in school
**R= Teachers in RO_1 & RO_2 sample
***V= Teachers in VIS sample

NOVA HIGH SCHOOL

TYPE AND DESCRIPTION	RANK 2 T*	RANK 2 R**	RANK 2 V***	RANK 3 T	RANK 3 R	RANK 3 V	Missing T	Missing R	Missing V
02 Advanced Post Graduate	64	11	9	0	0	0	0	0	0
03 Provisional Post Graduate	3	0	0	0	0	0	0	0	0
04 Graduate	3	1	0	37	5	7	0	0	0
09 Temporary	2	1	0	8	2	2	0	0	0
Other (01,05,07,22,23)	2	0	0	3	0	0	2	0	1
Missing	10	0	3	23	1	5	0	0	1
TOTALS	84	13	12	71	8	14	2	0	1

Table 1-3

Teachers by Certificate Rank and Type

Nova High School

*T= All teachers in High School
**R= Teachers in RO_1 & RO_2 sample
***V= Teachers in VIS sample

AGES OF PERSONNEL

AGE RANGE	NOVA I			NOVA II			HIGH SCHOOL			TOTALS		
	T	R	V	T	R	V	T	R	V	T	R	V
0 - 25	5	0	0	3	0	0	43	3	5	51	3	5
26 - 30	7	2	0	13	1	3	37	3	7	57	6	10
31 - 35	7	2	2	6	1	2	13	3	3	26	6	7
36 - 40	6	2	3	3	0	2	19	5	5	28	7	10
41 - 45	5	2	2	1	0	0	22	4	2	28	6	4
46 - 50	1	0	0	5	1	1	14	3	2	20	4	3
51 - 55	2	1	1	4	0	1	3	0	1	9	1	3
56 - 60	0	0	0	1	0	0	4	0	0	5	0	0
61 - 70	1	0	0	0	0	0	3	0	0	4	0	0
TOTALS	34	9	8	36	3	9	158	21	25	228	33	42

Table 1-4

Ages of all Nova Complex Teachers

Chapter II

INSTRUMENTATION AND DATA COLLECTION

Introduction

The purpose of this chapter is to explain the various instruments and techniques which were employed to gather data in this project. As noted in the preceding chapter, the activities of Phase I were systems analysis and data gathering efforts designed to identify relevant information about the teacher's role in the teaching system and, in particular, information about the systems management characteristics of the teaching system. The intention has been to make explicit, in as much detail as necessary, the basic elements, components, functions, inputs, constraints, etc. of the operating modes and procedures and the interaction of these within the system. To that end, various instruments and data collection techniques were chosen and developed for use in Phase I.

Since the focus of the project is on the classroom management characteristics of the teacher, it was decided to emphasize data collection techniques which concentrate on the teacher in the classroom. Consequently, various observational schemes were considered for use, including the potentialities of video tape recordings of operating classrooms.

No single, existing observational instrument provided the data needed to thoroughly examine the management role behavior of the teacher. While there is certainly no dearth of observational instruments available[1] which employ a variety

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[1]Illustrative observational schemes are represented by these references:

H. H. Anderson, "An Experimental Study of Dominative and Integrative Behavior of Children of Pre-School Age," Journal of Social Psychology, 8, (1937), pp. 335-345.

Mary Jane Aschner, James J. Gallagher, et al, "A System for Classifying Thought Processes in the Context of Classroom Verbal Interaction." (Urbana: Institute for Research on Exceptional Children, University of Illinois, 1962.) (Mimeographed.)

of behavioral classification systems, such instruments basically attempt to quantify the teacher's style or uniqueness of communication, either verbal or nonverbal or both. The use of these instruments has certainly contributed to a better understanding of what occurs in the classroom, expecially by quantifying the dyadic relationship between the teacher and the pupil, but none of the instruments are broad enough to quantify noninteractive teacher behavior.

In many ways, the various stylistic instruments seem to be predicated upon a "traditional" type of classroom in which the teacher continually interacts with the pupils. In an individualized instruction classroom, where the pupils are working more or less independently, stylistic instruments tend to break down. The teacher may only interact extensively with a very limited number of students in a given class period and there may be relatively long periods of time in which no teacher-student interactions occur. In such cases (especially the latter) the interaction analysis instruments do not adequately describe the classroom activities.

Further, interaction instruments alone cannot provide the data which is necessary to develop an understanding of the behavior associated with the role of the teacher at Nova. Behaviors involving logistical activities or system maintenance would be grouped indiscriminately into a category such as "Miscellaneous" or "Silence." Yet, it is a premise of the project that management behaviors of the teacher in the classroom are important to the success of the school, including, but extending beyond, those involved in teacher-student interactions.

Since an existing instrument could not be found to study the role of the teacher, initial use was made of a specimen

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Arno A. Bellack and Joel R. Davitz, The Language of the Classroom: Meanings Communicated in High School Teaching. U. S. Office of Education, Cooperative Research Project, No. 1497. (New York: Institute of Psychological Research, Teachers College, Columbia University, 1963.)

Ned A. Flanders, "Interaction Analysis in the Classroom: A Manual for Observers." (University of Minnesota, College of Education, August, 1960.)

Fred A. Honigman, Multidimensional Analysis of Classroom Interaction (MACI). (Villanova, Pennsylvania: The Villanova University Press, 1967.)

Donald M. Medley and Harold E. Mitzel, "A Technique for Measuring Classroom Behavior," Journal of Educational Psychology, 49, (1958), pp. 86-92.

description observational scheme in which almost anything which occurred in the classroom was recorded in writing. These observations were initially augmented by video tape recordings of the classroom activities. Almost immediately, problems developed with both of these methods of data collection.

It soon became apparent that specimen description was too cumbersome to use, in terms of both recording and analyzing. A coding or categorizing scheme was necessary to quantify specimen description records, and work had begun on such a scheme prior to the first observation. The categorizing system, which had been intended for analysis, was developed into a structured observation instrument. While a potential problem existed because the categorizing system had been designed with numerous cells, it was successfully converted into an observation instrument which imaginatively permitted reliable recording and coding of classroom teacher behavior. This instrument is discussed later in this chapter in the section entitled RO$_1$—Observation of Teacher Management Behaviors.

The video tapes were intended as a backup data collection system for the observations. The tapes were intended to permit repeated study of the same classroom situation to obtain new information or to clarify previously obtained information. Three video tape recorders were obtained and several classes were taped. From the outset, the taping was beset by technical problems such as: (1) quality sound pickup was extremely difficult even though a wireless microphone was placed on the teacher's person; (2) it was extremely difficult to adequately cover the teacher's movements with the camera and still capture enough student behavior to document the class activities; (3) when the teacher was away from the camera, a good shot of him and his activity was frequently

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Donald W. Oliver and James P. Shaver, The Analysis of Political Controversy: An Approach to Citizenship Education. U. S. Office of Education, Cooperative Research Project, No. 551. (Cambridge, Massachusetts: Harvard Graduate School of Education, Harvard University, 1962.)

H. V. Perkins, "Climate Influences Group Learning," Journal of Educational Research, 45, (1951), pp. 115-119.

B. O. Smith, et al., A Study of the Logic of Teaching. U. S. Office of Education, Cooperative Research Project, No. 258. (Urbana: University of Illinois, 1962.)

John Withall, "The Development of a Technique for the Measurement of Social-Emotional Climate in Classrooms," Journal of Experimental Education, 17, (1949), pp. 347-361.

impossible because the students and the furniture tended to block the line of sight; (4) equipment breakdowns caused frequent delays and poor recordings; (5) finally, several conflicts developed over the use of the remote microphones because they were also used by the observers. (The microphones are expensive and the quantity was limited.) Ultimately, all video recording was discontinued because of the problems. This decision was made, in part, because of the advice of a video recording expert that large, additional sums of money would be required to overcome the problems—amounts in excess of the budget.

While the main emphasis of Phase I was on the teacher, description of the student behavior as it related to the teacher was considered to be within the intent and purpose of the project. Student data contribute greatly to an understanding of the effect of various teacher behaviors on the goals of the school.

Exploration of the effect of the teacher's various management behaviors on student subject matter acquisition is desirable, but the data collection design necessary to study such relationships may be impossible to create in an ongoing school environment. Students obviously cannot be questioned or tested after each teacher management behavior occurs. Examination of scores earned on tests given at regular intervals could not be related to specific teacher behaviors. Even if characteristic teacher behaviors were used instead of specific instances, the large number of variables would confound any relationship and no reliable conclusion could be reached. Consequently, it was decided that the collection of student achievement data would not be productive to the study (even though such data should eventually be related to the teacher's role behavior.)

Student data which could be, at least, paired in time with the teacher behaviors was collected. Thus, only observed, overt students' behaviors have been recorded. Because the project is not concerned with all student behaviors, only a few specific types of behavior were collected. Two interaction analysis instruments, which provide some student data, were employed (these instruments are discussed later in this chapter). One instrument, the Verbal Interaction Scale, codes only "Student-Talk-Initiation" and "Student-Talk-Response." The other instrument, the Multidimensional Analysis of Classroom Interaction, codes five basic categories of student behavior, each of which can be identified as "spontaneous" or "solicited." A third instrument, the RO_2, was developed to collect additional student data. The RO_2 is primarily concerned with the frequency of student-teacher interactions, the initiation of such interactions, and the time involved in attempting to initiate an interaction. Collectively, these three instruments provide limited, but important, student data.

The observation instruments which were used may be divided into two groups. The first group consists of the two instruments which emphasize the management characteristics of the classroom and were created specifically for the project. The second group consists of two instruments prepared elsewhere but considered useful to this project—the Verbal Interaction Scale (V.I.S.) developed by Flanders,[2] and the Multidimensional Analysis of Classroom Interaction (MACI) developed by Honigman.[3]

Various interview and random sample discussion techniques were used to gather extensive anecdotal or impressional data for use in the project. The primary use of this information was to provide background and to familarize and sensitize the project staff to the Nova Complex.

An independent organizational study was designed and begun during this phase of the project and its results will be available during Phase II. Consequently, several instruments employed in this independent study are briefly discussed in this chapter. The study is concerned with attitudinal and communicational patterns of Nova High School teachers and administrators and will provide data which will be valuable to subsequent phases. Many of the data being collected by this independent study would have been collected by the Teachers Role Project if the other study had not already been planned.

The proposal for the Teachers Role Project stated that the project would utilize the data bank which was developed on the students and teachers of the Nova Schools under Ford Foundation and Broward County sponsorship. This data bank includes information gathered during a three-year study of Nova I (elementary) and a five-year study of Nova High School undertaken by researchers affiliated with Florida State University. At the time of this writing, the final report on the elementary school project has been completed,[4] but the final report on the high school has not been completed. Because of the nature of the commitment to Broward County, data collected by the high school project <u>cannot</u> be used by other investigators prior to the official release of the report. Consequently, information is not yet available on the high school.

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[2]Flanders, op. cit.

[3]Honigman, op. cit.

[4]Robert J. Jones, Garrett R. Foster, and Hazen A. Curtis, <u>Elementary School Evaluation Project: An Evaluation of Nova Elementary School #1 During the First Three Years of Operation, 1965-1968</u>. (Florida State University, 1968.) (Mimeographed.)

The elementary study primarily involved a multivariate comparison of data on Nova I teachers and students to similar data for two other Broward County elementary schools. The data on the teachers were collected with five instruments—these are: the Organizational Climate Description Questionnaire (OCDQ),[5] the Teacher Characteristics Schedule (TCS),[6] the Dogmatism Scale,[7] the Test of Imagination, Form D,[8] and the What is an Ideal Child? test.[8] Except for the "Ideal Child" instrument, there were no significant differences between the Nova teachers and the comparison schools. On the "Ideal Child," the researchers conclude that the Nova faculty may be shifting toward desiring a more passive child as their ideal, while the comparison teachers seem to be asking for a less passive child.

Because all the teachers in the study were guaranteed anonymity by the researchers, all identification codes were destroyed upon completion of the report. Consequently, while the Teachers Role Project has access to the data bank of the elementary evaluation project, the data are not useable for any analyses in which they are related by teacher to the behavioral data gathered in Phase I. Consequently, no new analyses of the data bank study have been undertaken.

The elementary project's data which was collected on the pupils in Nova I include measures of imagination, curiosity, anxiety, intelligence, and achievement. However useful these data are in describing in general terms the pupils at Nova and in comparing them to other schools, they are not particularly useful to the role project's objectives. There is no way in which these data can be related to any specific behavior in which the Nova teachers engaged. Consequently, no use has been made of pupil data collected by the evaluation project.

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[5] Andrew W. Halpin, Theory and Research in Administration. (New York: MacMillan, 1966.)

[6] David G. Ryans, Characteristics of Teachers. (Washington, D. C.: American Council on Education, 1960.)

[7] Milton Rokeach, The Open and Closed Mind. (New York: Basic Books, 1960.)

[8] Paul Torranie, Rewarding Creative Behavior. (Englewood Cliffs, New Jersey: Prentice-Hall, 1965.)

THE FUNCTIONAL ANALYSIS INSTRUMENTS

RO_1—Observation of Teacher Management Behaviors

Primarily, the RO_1 provides an extensive base for the analysis of the teacher as a manager of the educational process. Functions of the instructional role and areas of management responsibility are identified, and by quantifying and describing the components of these areas, teacher performance can be evaluated, both in the framework of effective managerial techniques and the implications of the priorities and techniques exercised.

The instrument considers such areas of teacher options as quantitative interactions, discipline, beneficial time utilization, passive versus active role manifestation, class tenor, and nature of individual contacts. Each of the options or areas of management is examined in terms of its facets, e.g., the area of quantitative interaction is described in the framework of quantity, length of each interaction, the interaction participants, the initiator, the number of students in class, and the audience. This information is complemented by the RO_2, described in the next section, which records how frequently the teacher interacts with each student, and how many students waited for what period of time for teacher attention or assistance. With this array, it is possible to determine what proportion of students the teacher interacted with; what proportion of the interactions were student initiated; the average length of each single student-teacher interaction; if the teacher spent large blocks of time with several students who had problems, did this curtail the teacher's ability to contact students who needed attention; if the majority of time was spent with single students, small groups, or the class as a whole; the number of exchanges which normally constitute an interaction, etc. Essentially, this information reflects basic management choices the teacher has made; which should be evaluated in terms of student effect. Particularly in the innovative classroom, the implications of "nonmanagement" can be as profound as mismanagement.

The instrument also reflects the influence of the educational milieu on the teacher, describing the more subtle structuring of the teacher's role by the system, as well as the inhibiting and supporting agents. The RO_1 provides a task description of the teacher in the classroom, which inherently has implications for teacher training.

The primary RO_1 focus is the teacher's management activities and functions. Each teacher activity is recorded as it occurs, modified by the general realm of management into which it falls. In the coding scheme, these realms are reflected by the first digit of the four number category codes as follows:

1 _ _ _ Cognitive

2 _ _ _ Educational Environmental

3 _ _ _ Affective and Social

The component of the managerial realm is also indicated. These are identified in the coding scheme by the second digit of the four category numbers as follows:

_ 1 _ _ Events in which the teacher deals with technical data or instructional media

_ 2 _ _ Events in which the teacher deals with instructional devices or equipment in a classroom

_ 3 _ _ Events in which the teacher executes logistical management responsibilities

_ 7 _ _ Management Procedures or Tactics

The last two code digits identify specific behaviors. A description of the category codes is included in Appendix B in the RO_1 Code Book. A summary list of these descriptions follows:

Technical Data - Cognitive Realm

1101 - Preparing instructional materials.
1102 - Searching through instructional media to aid students.
1103 - Imparting subject matter information with aid of technical data.
1104 - Imparting subject matter information via technical data.

Technical Data - Educational Environmental Realm

2101 - Planning schedules or preparing managerial materials.
2102 - Using noninstructional management material.

Equipment - Cognitive Realm

1201 - Coping with instructional device breakdowns.
1202 - Readying or trying to obtain equipment for instructional use.
1203 - Imparting subject matter information with aid of equipment.
1204 - Using an instructional device or other equipment in an instructional situation.

Equipment - Educational Environmental Realm

3201 - Dealing with equipment not directly related to the educational system.

Logistics - Cognitive Realm

1301 - Anticipated cognitive logistical tasks.
1303 - Unforeseen cognitive logistical tasks.

Logistics - Educational Environmental Realm

2301 - Logistical tasks which maintain the educational environment but are not directly related to cognition.
2304 - Moving students from one place to another.
2305 - Logistical constraints.
2306 - Obtaining or attempting to obtain material for personal use.

Logistics - Affective and/or Social Realm

3301 - Student related logistical tasks which are not directly related to a student.

Procedures - Cognitive Realm

1701 - Rewards for subject matter achievement and/or performance.
1703 - Presenting information.
1704 - Assignments and instructions for locating information.
1707 - Instructions and directions used to aid students who are having cognitive problems with specific assignments.
1708 - Pep talks or short motivational statements.
1709 - Short negative evaluative comments of subject matter performance.
1712 - Questions which require subject matter comprehension.
1713 - Examination or evaluation of a specific facet of student subject matter performance, progress, or tasks.

Procedures - Cognitive Realm (Cont'd.)

1714 - Short unstructured inquiries to determine if a student needs subject matter assistance.
1715 - Requests for elaboration on a student response or contribution.
1716 - Illustrations of the use of the subject matter information being presented.
1721 - Positive progressive reinforcers.
1723 - Giving grading information.
1731 - Giving logistical information about instructional devices or materials.

Procedures - Educational Environmental Realm

2701 - Rewards for either student application to subject matter assignment or support of the educational system.
2702 - Punishers for either lack of application to assignment or performance which is not supportive of the educational environment.
2703 - Noncognitive directions, statements, requests, and inquiries used to manage cognition.
2704 - Information about procedures, operations, and regulations of the educational system.
2706 - Using students to do nonlogistical supportive tasks.
2707 - Statements or directions used to either direct students to conform to the expectations of the educational system or to change a specific classroom situation.
2708 - Pep talks or short motivational statements.
2709 - Attempts to control disruptive students.
2710 - Controlling whereabouts of students.
2711 - Grouping students.
2712 - Questions related to the educational system which do not require subject matter comprehension.
2713 - Examining or evaluating either the educational environment or the student's adaptation.
2714 - Threats related to educational systems expectations.
2715 - Alteration of classroom procedures to compensate for external systems constraint or demand.
2717 - Responding to relevant stimuli indicating a possible environmental systems problem for the students.
2718 - Requesting students to do logistical tasks.
2721 - Evaluative positive comments about student noncognitive educational performance.
2731 - Logistical statements about noninstructional material or equipment.

Procedures - Affective and/or Social Realm

Sub-category 1-19 - Shaping of student values, attitudes, and feelings.

3701 - Rewards.
3703 - Imparting information.
3704 - Guidance or counseling.
3707 - Directions used to direct students to conform to perceived social standards.
3708 - Pep talks or short motivational statements.
3712 - Questions related to affective behavior or performance.
3713 - Specific evaluation of student adaptive or affective performance.
3717 - Responding to physical or behavioral signs indicating that there might be a student adaptive problem.

Sub-category 23-40 - Social realm.

3723 - Information about the outside world.
3724 - Guidance or counseling.
3732 - Questions.
3733 - Evaluation or examination of specific facets of student outside world performance or condition.

Recording Techniques

Optimally, during a recording session, an observer uses a legal sized pad of paper, a pocket watch on which the second hand and minute markings are clearly visible, and a sensitive microphone and receiver.

The observer focuses on teacher activities, recording each event by code and/or comment as dictated by time and the situation. A recording technique is used which places each event in the context of time duration, interaction participants, and initiator of interaction, and audience. An excerpt from an observation is included in Appendix B.

After the observation, the classroom recordings are reviewed, coded, and entered on the data bank forms, the instructions for which are included in Appendix B, RO_1 Data Bank Form Instruction Sheet. The information on the forms is then keypunched for inclusion in the Master Data Bank.

Sample Selection

The intiial sample selected with the assistance of a Table of random numbers consisted of 23 teachers in Nova High School, 10 teachers in Nova II Elementary School, and 12 teachers in Nova I Elementary School. This group constituted our core sample and was evenly distributed across the departments in the high school, and the grades or suites in the elementary schools.

Because of the disparate opening dates of the schools, the unavailability of teacher schedules and room assignments, and the fact that we wanted a broad-based sample which would enable us to better evaluate the representative quality of our core sample, the four observers randomly observed for a period of approximately three weeks in the initial stages of the project. This broadened our overall sample to 67 teachers in the high school, 22 in Nova II Elementary, and 20 teachers in Nova I Elementary.

During the project, after the RO_2 was developed, one of the RO_1 elementary school observers was reassigned to the RO_2. This decision was predicated on the fact that only one RO_2 observer served three schools, while there were four RO_1 observers. This reduced the core sample in the elementary schools. Because of the ES'70 affiliation, the high school sample was kept intact. After the instrument was developed and the supportive audio equipment supplied, the core sample was further reduced by attritional events and by incidents of teachers not teaching for extended periods while writing LAPs, etc.

After our initial scheduling attempts, a schedule of observations was not compiled. Our early efforts were hopelessly confounded by substitute teachers, teacher interns, teachers preferring not to be observed on a particular day, teachers not appearing in team taught classes, etc. Nevertheless, an attempt was made to observe each teacher in the different instructional situation in which the teacher was involved, e.g., a lab, a small group discussion, a team teaching situation, etc.

Ultimately, 396 RO_1 observations were made, 106 of which were coded and used in the following analyses.

Reliability

Normally, the large number of RO_1 categories would be expected to reduce the reliability factor in that the greater the number of discriminations which must be made, the less reliable the data. In the RO_1, this situation is ameliorated by the unique nature of the instrument; for example, while recording in class, the observer is not constrained by having to irrevocably code a classroom event. When an observer is uncertain about the proper categorization of an event, it is recorded in descriptive form, as are other specified incidents in which categorization would be enhanced by elaborative comments. After the observation session, events which the observer was not able to positively code are discussed with all of the observers present. This constituted a continuous training and/or refresher program for the observers.

In addition, the inclusion of descriptive comments on the coded observations permitted the coded observations to be double checked. This review, combined with the delayed identification capability, should render the data in this study more reliable than the inter-observer reliability tests indicate.

Another factor which minimizes the stigma of proportionately reduced reliability is the built-in modifying characteristic of the coding scheme, wherein all teacher events are coded according to their pertinent realm (e.g., cognitive, systems, or affective). Category codes may differ only by the realm to which they relate, e.g., the teacher giving rewards occurs as behaviors in all realms. Another technique, an associative one, that was used to increase the reliability was the consistent use of a suffix digit across realms, e.g., all "_ _ _ 3" events denote information given. Another contributory factor was the general policy of discarding the initial observation of each teacher, using that observation primarily as a familiarization tool.

In order to obtain a numerical value for reliability, the Scott coefficient used by Flanders was employed on our coding forms. Scott (1955) suggested this index of intercoder agreement because it is not dependent on the number of categories and because it does not assume that all categories have equal probability of use. The coefficient, π, corrects for the number of categories and the frequency with which each is used in a nominal scale. The formula is:

$$\pi = \frac{P_o - P_e}{1 - P_e}$$

where P_o represents the percentage of events on which the two coders agree when coding the same data independently, and P_e is the percent agreement to be expected by chance. Therefore, π can be roughly interpreted as the extent to which the coding reliability exceeds chance.

The total probability of chance agreements equals the sum of the probabilities of agreement on each of the categories taken individually. This is assuming that the categories are mutually exclusive.

The expected percent agreement for the dimension is the sum of the squared proportions over all categories.

$$P_e = \sum_{i=1}^{K} P_i$$

where K is the total number of categories and P_i is the proportion of the entire sample that falls in the i^{th} category.

On a recent set of simultaneous observations, the percentages of observer agreement and the Scott coefficient are as listed below. These figures are in keeping with other reliability tests made.

Name	Agreement %	Scott Coefficient
Damveld-Dogan	82%	.76
Corriveau-Dogan	82%	.76
Brassard-Dogan	81%	.75
Damveld-Brassard	79%	.72
Corriveau-Brassard	79%	.70
Damveld-Corriveau	79%	.70

The RO_2—Observation of Student Interaction, Participation, and Attention Getting

After two months of testing the RO_1, it seemed valuable to supplement it with another instrument which would place its teacher orientation in perspective by noting the extent of student participation in the classroom. It also seemed desirable to record the number of times the teacher interacted with each student. While the RO_1 recorded each interaction and indicated who initiated each event, it failed to relate interactions to individual students.

The primary purpose of the RO_2 is to record the number of interactions the teacher has with single students, excluding brief disciplinary and control statements. These interactions are identified by whether they are student-initiated or teacher-initiated. Student-initiated events in which the students seek materials or assistance with materials are designated as such.

The secondary purpose of the RO_2 is to ascertain the extent of student participation in the classroom. The instrument records instances of students either being disruptive or not participating in the cognitive activity of the classroom. To place the recorded instances of student nonparticipation in perspective, the observer periodically notes the extent to which the class, as a whole, appears to be either participating in or attentive to the subject matter assignment.

Another facet of the classroom recorded on the RO_2 is the number of students attempting to get teacher assistance or attention. Usually, such an occurrence is not recorded unless the student has been actively seeking aid for approximately fifteen seconds (exact timing is not always possible). The length of time before the teacher subsequently interacts with the student is also recorded.

Teacher responses to student requests in less than fifteen seconds are not directly recorded but are derived from other information. Also included are those instances in which students try to get or are getting materials needed to complete class work. Finally, an attempt has been made to periodically record the relative noise level during the observation period. Determination of the noise level is done subjectively by the observer and there is no intent that this measure should correspond to precise physical measures of loudness or volume.

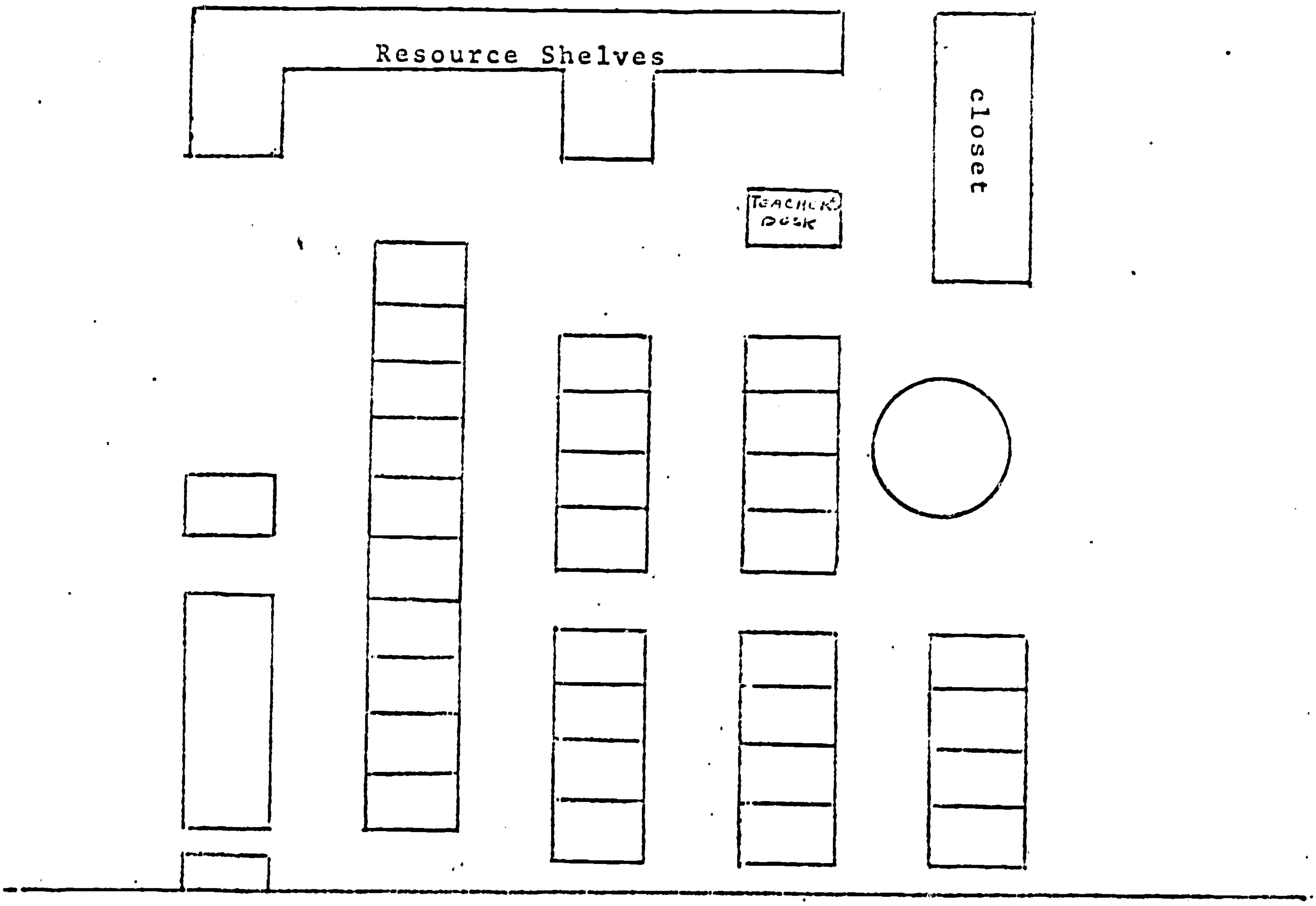
The RO_1 and the RO_2 observations were recorded simultaneously. When possible, the RO_2 observer was supplied with the same basic equipment as the RO_1 observer—a large pocket watch, a sensitive microphone, and a receiver with earphones.

The observation is facilitated by a 5" X 8" room diagram or floor plan which shows the students' desks or seating arrangement. As the teacher and student interact, the observer records a "T" if the interaction was initiated by the teacher, an "M" if the interaction was initiated by a student seeking material assistance, and an "S" if the interaction was initiated by a student seeking other than material assistance. These letters are then recorded on the floor plan by the seating location of the student no matter where the interaction took place. Even when the observer is faced with the challenge of a large class of students who interact with the teacher in multiples in various areas of the room, he is able to and does follow both the students who interact with the teacher to determine their seating locations and the interactions in progress.

After the early development stage of the RO_2, floor plans were drawn and reproduced for all of the rooms in which observations were planned. A copy of one of the plans is shown in Figure 2-1.

The main focus of the RO_2 observer's attention is the student-teacher interactions, but other pertinent events are recorded as they are noted, referenced by time, and recorded in modified specimen description. (An example of these classroom notes is shown in Appendix B.)

After an observation, the notes of an RO_2 observer are coded, recorded, and later keypunched for inclusion in the



Room 7 - Suite C - Nova I

REPRESENTATIVE RO_2 FLOOR PLAN

Figure 2-1

data bank. Detailed instructions for coding the RO_2 observations are included in Appendix B, RO_2 Data Bank Form Instruction Sheet.

The series of code numbers used in RO_2 are as follows:

4000's - Descriptions of the extent of student participation.

5000's - Subjective observer comments.

7000's - Analyses of the student-teacher interactions.

Detailed descriptions of the specific codes used are included in the RO_2 Code Book in Appendix B. These codes are briefly identified below:

Observer Comments

Code No.	Identification
5000	General comments about the observation and the class.
5001	Equipment used by observer.
5003	Comments on the teacher as manager.
5004	Number of instructional personnel in class; general division of labor.
5005	Teaching style.
5006	General discipline and class activity.
5007	Teacher's performance that day.
5008	Amount of individual attention.
5009	Observer stops observing during observation for a period.
5010	Teacher characteristics, mannerisms, and views.
5011	Teacher background information.

Interaction

7008	Number of students with whom teacher interacted.
7009	Number of times each student interacted with teacher.
7010	Initiator of interactions.

Student Participation

4706	Nonparticipating or disruptive student events.
4707	Participating student activities.
4712	Noise level.
4716	Students seeking teacher's assistance or attention.
4717	Students seeking materials.

Because this instrument was designed to complement the RO_1, the sample selected was the same as the RO_1's but because of occasional logistical problems, every RO_1 observation does not have a companion RO_2 observation.

In order to establish a general pattern of observer reliability for the RO_2 student-teacher interaction description, the total number of single student-teacher interactions from three randomly chosen RO_2 observations were compared with the total number of single student-teacher interactions, excluding brief disciplinary and control statements, in the counterpart RO_1 observations. In these three instances, there was 98% agreement on the student-teacher interactions. The high percentage of agreement on interactions implies that other aspects of the instrument are also reliable and no attempt was made to determine reliability on those aspects of the instrument.

THE VERBAL INTERACTION SCALE (VIS)

The Verbal Interaction Scale developed by Ned A. Flanders provides an instrument for observing and recording verbal interaction which claims to minimize observer biases. The VIS gives the data analyst a systematic record of events in a classroom—events that are concerned with the influence pattern of the teacher.

This instrument is concerned primarily with verbal behavior. Verbal interaction proponents claim that verbal behavior can be observed and recorded much more reliably than other types of behaviors. Further, they assume that an individual's verbal behavior provides an indicative example of his total behavior.

In order to thoroughly define and analyze the teacher's role, it was necessary to gather data concerning teacher verbal behavior. Consequently, the VIS was used as a supplement to the RO_1 with this purpose in mind. Also, since the VIS has been used extensively in many different school environments, its inclusion as an instrument provides the reader with data which can be used to compare the Nova Schools with other instructional settings.

The Verbal Interaction Scale is comprised of ten categories. Seven categories are assigned to teacher talk and two to student talk. The tenth category classified pauses, short periods of silence, and talk that is confusing or noisy.[9] Westinghouse Learning Corporation added a category to the teacher talk portion of the instrument for events where the teacher ignores or cuts off students. The Teachers Role Project utilized this modified form of the Verbal Interaction Scale, as shown in Table 2-2.

The teacher talk category system can be divided into two more parts: Those which classify teacher influence as being direct and those which classify it as being indirect. Indirect influence encourages student participation and encourages freedom of action. This is represented by categories one through four. These categories tend to increase student

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[9]Ned A. Flanders, Interaction Analysis in the Classroom. Revised Edition. (The University of Michigan, 1966.)

TEACHER TALK	INDIRECT INFLUENCE	1. *Accepts Feeling: accepts and clarifies the feeling tone of the students in a nonthreatening manner. Feelings may be positive or negative. Predicting or recalling feelings included. 2. *Praises or Encourages: praises or encourages student action or behavior. Jokes that release tension, not at the expense of another individual, are included. Nods head or says, "um hum?' or "go on" also included. 3. *Accepts or Uses Ideas of Student: clarifying, building, or development ideas suggested by a student. As teacher brings more of his own ideas into play, shift to category 5. 4. *Asks Questions: asking a question about content or procedure with the intent that a student answer.
	DIRECT INFLUENCE	5. *Lecturing: giving facts or opinions about content or procedure; expressing his own ideas. 6. *Giving Directions: directions, commands, or orders to which a student is expected to comply. 7. *Criticizing or Justifying Authority: statements intended to change student behavior from nonacceptable to acceptable pattern; bawling someone out; stating why the teacher is doing what he is doing, extreme self-references. 8. *Ignoring or cutting off students.
STUDENT TALK		9. *Student-Talk-Initiation: talk initiated by students. The ideas expressed are created by students; statement content not easily predicted by previous action of teacher. 10. *Student-Talk-Response: talk by student in response to teacher. Teacher initiates the contact or determines type of student statement. As a student expounds his own ideas, shift to category 9.
SILENCE OR CONFUSION		11. *None of the Above: routine administrative comments, silence or confusion; interaction not related to learning activities.

*Note: The category numbers are purely nominal, no scale is implied.

VERBAL INTERACTION SCALE CATEGORIES

Table 2-1

participation by reinforcing the students through the acknowledgement of a feeling or the employment of an idea issued by the student.

Direct influence increases teacher participation and places constraints on student participation. Categories five through eight are in this subdivision.

The division of student talk into only two categories, nine and ten, neglects a great deal of information; but the primary purpose for using this instrument is to record data concerning teacher behavior. Nevertheless, the student talk categories provide valuable information about the classroom and to some extent about the teacher.

Sample and Method

The sample of teachers employed for the collection of VIS data was different from that employed for the other data collection techniques. The sample consists of 53 teachers drawn randomly from the three Nova Schools. Two teachers were chosen from each of the four suites in Nova I and from each of the five suites in Nova II. In the high school, five teachers each were chosen from the English, Language, Social Studies, Science, and Mathematics Departments. Ten teachers were selected from the Technical Science Department. As would be expected, there is some overlap between the VIS sample and the RO_1 sample.

Two observers were used to collect the VIS data and each observer made one twenty minute observation on each teacher in the sample. Thus, a total of two observations were made for each teacher. During each observation period, observable behavior was recorded at three second intervals.

MULTIDIMENSIONAL ANALYSIS OF CLASSROOM INTERACTION (MACI)

In order to analyze the instructional relationship between teacher and student, it seemed necessary to quantify certain elements of communications between them. Consequently, in order to better understand the relation of the student in the classroom to the teacher in the classroom, the Multidimensional Analysis of Classroom Interaction (MACI) observation system was employed under the direction of its developer, Fred K. Honigman.[10] This instrument tends to be one of the most sophisticated of the various ones which attempt to quantify the uniqueness of each teacher's communication pattern or "style."

MACI deals with the affective, control, and cognitive dimensions of teacher influence in three separate ways—descriptively, analytically, and evaluatively. Thus, teacher influence is defined by observing what happens, how it happens, and how well it happens.

The MACI instrument utilizes categories that are divided into three sections: Teacher Behaviors, Student Behaviors, and Other. All nonverbal, as well as verbal, behaviors are classified in the appropriate categories.

The affective dimension of analysis focuses on the mood of the classroom and the behaviors of teacher and student that contribute to this mood. One way MACI evaluates the emotional climate of a classroom is by comparing the supportive (accepting) behaviors with the nonsupportive (rejecting) behaviors that a teacher performs.

The control dimension examines teacher regulation of the classroom and gives a general commentary on classroom organization. In essence, it looks at the state-of-affairs in the classroom in terms of control. In order to do this, MACI examines two kinds of information: The first is the extensiveness of teacher regulation of student behavior or the amount and type of protocol involved in communication; the second is a description of the patterns of activity and communication of teacher behavior concerned with control.

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[10] Honigman, op. cit.

The cognitive dimension looks at the conceptual nature and level of instructionally related activity in the classroom. It is concerned with analyzing teacher and student cognitive behaviors emphasizing the techniques used by the teacher that cause the observable student participation.

The Standard MACI Categories are listed according to their divisions and are shown with the symbols used in recording an observation using MACI in Table 2-3.

In addition to these standard categories, other codes and conventions are employed in the MACI scheme. For example, if student behavior is spontaneous (i.e., not directly solicited by the teacher), the observer indicates the spontaneity by placing an "X" beside the behavioral code.

The data collected by using this instrument can be examined in three basic ways:

1. In terms of the number of times that different kinds of behavior or events occur during the observation period.

2. In terms of the number of times that various sequences of behavior occur during the observation period.

3. In terms of the typical length of performance of the various behaviors.

For the specific purposes of the project, only limited aspects of the data were utilized. Various "proportional" terms can be calculated from the data by dividing the frequency of specific measures by the frequency of some larger grouping.[11] For example, the proportion of relative amount of spontaneous, unsolicited student behavior can be determined by dividing the number of "X" items (spontaneous student behavior) by SB, the total number of student behaviors. Similarly, other proportions can be calculated. Seventeen such proportions and three typical time measures were used in the analyses in this project. These measures are shown in Table 2-4. The codes which are used in the Table and which have not been previously discussed are defined below:

1. SB is the sum of all student behaviors except misbehavior (category 3).

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[11]Descriptions of some of these proportions are described in Norma F. Furst and Fred K. Honigman, A Study of Pupil-Teacher Interaction Patterns in Experimental Communications Courses Compared With Those in Traditional Junior High School English Classes. Paper presented to the American Educational Research Convention, Los Angeles, February, 1969.

SYMBOL	CATEGORY
	TEACHER BEHAVIORS
○	Performs Emotionally-Supportive Behavior
a	Designates Student Performance "Acceptable"
aa	Praises Performance
b	Designates Student Performance "Unacceptable"
bb	Criticizes
c	Uses or Discusses Students' Ideas
ⓒ	Uses or Discusses Students' Feelings (Emotions)
d	Solicits an "Original" Contribution
e	Solicits a "Pre-Established" Contribution
dc	Seeks Expansion or Elaboration of Students' Contributions
K	Selects Participant
L	Lectures and Gives Information
	STUDENT BEHAVIORS
1	Gives an "Original" Contribution
2	Gives a "Pre-Established" Contribution
~~1~~	Digresses; Gives a "Contextually Irrelevant" Contribution
①	Expresses Feelings (Emotions)
3	Misbehaves; Shows Hostility
	OTHER
S	Silence
M	Miscellaneous

The MACI Categories[a]

Table 2-2

[a]Norma F. Furst and Fred K. Honigman, A Study of Pupil-Teacher Interaction Patterns in Experimental Communications Courses Compared With Those in Traditional Junior High School English Classes. Paper presented to the American Educational Research Association Convention, Los Angeles, February, 1969.

TABLE 2-3 MACI MEASURES USED IN THE ANALYSES

Proportion[a]	Definition
1/1+2	The proportional of all (relevant, cognitive) student behaviors accounted for by students' original contributions (i.e., inferences, opinions, judgements, etc.)
(1-1T)/(1-1T)+(2-2T)	The proportion of all (relevant, cognitive) student behaviors excluding those performed on a total-class basis that are accounted for by students' original contributions excluding those performed on a total-class basis.
M2+MT/SB	The proportion of all student behavior accounted for by menial and organizational behavior, such as lining up, passing out papers, putting chairs under tables, etc.
2T/2	The proportion of all low-level (i.e., factual, information-giving) student contributions that are performed on a total-class basis.
2T/SB	The proportion of all student behaviors accounted for by total-class performances of low-level (factual) contributions.
RCF 1	The typical length of students' original contributions (i.e., inferences, judgments, opinions, etc.).
RCF 2	The typical length of students' low-level contributions (i.e., factual, information-giving.

TABLE 2-3 (Cont'd.)

Proportion	Definition
0+aa/TB	The proportion of all teacher behaviors accounted for by supportive activity (i.e., empathy and praise).
bb/TB	The proportion of all teacher behaviors accounted for by overt punitive behavior.
1/SB	The proportion of all student behavior accounted for by expressions of emotions.
RCF 1	The typical length of students' expressions of emotion.
3/SB+3	The proportion of all student behaviors (including misbehavior) accounted for by misbehavior.
SB/SB+TB	The proportion of all behaviors performed during the observation (by both teachers and pupils) that are accounted for by student behaviors.
X/SB	The proportion of all student contributions that are given spontaneously (i.e., without being solicited by the teacher).
(1-X)+(2-X)+(1-X)+(1-X)/SB	The relative amount of student-to-student interaction: The proportion of all student contributions accounted for by students's immediate reactions to other students' contributions.

TABLE 2-3 (Cont'd.)

Proportion	Definition
K/SB	The proportion of all student contributions for which the teacher has selected a specific
L/TB	The proportion of all teacher behavior accounted for by lecturing and information-giving.
d+e/d+e+L	The proportion of all of the teacher's content-related activity that is accounted for by his solicitation of student contributions (the relative number of questions that he asks).
dc/TB	The proportion of all teacher behavior accounted for by seeking students' expansion of their own contributions.
C/TB	The proportion of all teacher behaviors accounted for by expansion or elaboration of students' contributions.

[a]Measures identified by "RCF" are not proportions. They represent, "Ratio to Category Frequency"—the ratio of the number of "prolonged performance" recordings for any category to its frequency of occurrence during the observation period.

2. TB is the sum of all teacher behaviors.

3. T designates activities engaged in by the entire class (e.g., 3T indicates total class misbehavior).

The measures in the Table indicated by "RCF" (e.g., RCF 1) indicate typical length of performance of the activity shown (see Table 2-4).

Sample Selection

The MACI observers used the same sample of teachers that was randomly selected for use with the RO_1 instrument for data collection. One to three observations were made on each teacher in the sample.

Observing

MACI observers were given specific training in the use of the MACI instrument before entering the classrooms for observation. Honigman establishes a satisfactory level of reliability between field observers before assigning them to data collection assignments. He compares all observers against himself on all categories of MACI, using the Scott correlation coefficient (see above) requiring a coefficient of .70 for observer qualification.

MACI observers record category symbols on a three-second basis similar to that used on the (S—every three seconds a symbol is recorded to designate events or behaviors occurring at that particular time. Each observation was for a period of twenty minutes.

UNSTRUCTURED DATA COLLECTION: INTERVIEWS, DIARIES, MEETINGS, ETC.

Since baseline data about the teaching system in the Nova Complex needed to include all possible aspects of the system in relation to the teacher, a variety of information from different sources was necessary. One source of this information was the teacher. The resident observers in each of the Nova Schools recorded unstructured interviews—both formal and informal—with many of the teachers concerning their expressed feelings and attitudes about such things as lines of communication, appropriateness of materials, administration, and many other areas of teacher concern. The informal interviews were generally conversations or remarks offered by the teacher without solicitation from the resident observers. The formal interviews were composed of definite questions by the resident observers with selected teachers and department heads.

The general purpose of these data was (1) to familiarize the staff of the project with operating procedures, principles and various details of Nova Complex operations; (2) to sensitize project staff to areas of the teaching system which might be important to observe; and (3) to possibly supplement the information gathered through the use of the more objective and more structured data collection techniques employed by the project.

Another method of data gathering which was designed to provide general information about the school was teacher diaries, three of which were commissioned. The teachers volunteered to record their feelings and reactions to various events which took place in class and out of class, time spent on various activities, and anything else which they cared to include. The teacher recorded daily entires and delivered them to the project offices weekly. Three Nova teachers—one in each of the three schools—were engaged in this activity from August through December of 1968. The particular teachers were arbitrarily selected from those who were interested and they were paid for maintaining the diaries. There was no intention for the teachers involved to be considered representative in any way of the other teachers. Rather, the diaries provided general information about events which could not be obtained readily from other sources. In addition, of course, the diaries provide insights into the thoughts and feelings of the three teachers.

These diaries were read by project personnel each week and studied for possible general and specific problem areas which should be investigated. No specific references are made in this report to the content of any of the diaries because the teachers were assured that what they wrote would be regarded as confidential. Nevertheless, the diaries have contributed significantly to the report.

Meetings on every level have an effect on teacher role and as an additional informal data collection effort, transcripts of pre-planning department meetings, school-wide meetings, and county-wide meetings were obtained. This information was used to aid in defining constraints that are placed on the teacher and to better understand the structure in which he works.

All of this unstructured information contains considerable bias and subjectivity, but when used to supplement and interpret the more objective data which were collected, a better and more complete picture is obtained of the teacher's role and the inner systems constraints that exist at Nova. It is believed that the inclusion of the data has provided a broader basis from which to analyze and draw conclusions about the current role of the teacher than could be provided using only the quantifiable data.

ORGANIZATIONAL STUDY

Because teachers are affected by interpersonal contacts which might tend to influence classroom behavior, Dr. William Love and Dr. Judith Steward of Nova University are conducting a study to collect data on teacher satisfactions, contacts, expectations, feelings about the Nova system as opposed to the "ideal" Nova system and opinions about education. This activity will continue through the Spring of 1969 and the results will be available for Phase II of this project.

Description

The data are being collected through the use of five instruments. These instruments are to be distributed to the total Nova High School faculty, but the administration requires that completion of the questionnaires must be on a voluntary basis. At the time of this report, the first questionnaires have been distributed to the faculty. The instruments were developed after several months of interviewing former Nova personnel and pretesting of prototype instruments.

Organizational Study (Form I)

The first instrument is a faculty check list. The teachers are asked to check the names of fellow faculty members to whom they go when they have a problem. Assuming that certain members of the faculty would be unofficially considered experts in certain areas, such as the writing of LAPs or the use and operation of audio-visual equipment, the check lists should pinpoint those particular persons. In this way, it is possible to select those teachers to whom the faculty members in general would go for help with the later possibility of studying these resource persons in order to isolate existing behaviors or characteristics that seem to contribute to their selection as resource persons.

The form given to the teachers is simply a list of the names of the school personnel. Teachers are instructed to check the names of the persons to whom they might talk about how to get their job as a teacher done. Instructions for this form are found in Appendix B.

Organizational Study (Form II)

This questionnaire is concerned with the professionalization of the teacher, and is based on the assumption that teacher performance is influenced by teacher expectations, both past and future. It is felt that there may be a marked difference between the attitudes and practices of those teachers who view themselves as moving upward into administration, those who view themselves as static in their present position, and those who consider teaching as a short-term employment situation. Insights into professional standards of the teacher can be gained through the analysis of information gathered through this questionnaire. This questionnaire is found in Appendix B.

Organizational Study (Form V-T)

This instrument is composed of 45 statements about education in general, about Nova in particular, and about Nova as opposed to other school systems. For example, items are included which deal with satisfaction with Nova, with supervisors, and with staff relationships. Other items involve the curriculum, the administration, innovation, and similar topics. The teachers are requested to mark the questionnaire on a seven-point Likert scale indicating their personal opinion on these statements. This questionnaire may be found in Appendix B.

Organizational Study (Form VI-T)

Questions of an essay type were included in this instrument to allow the teachers to express their opinions concerning Nova, career alternatives, expectations and satisfactions in as much detail as they desire. This would indicate perspective of teachers in relation to real or fantasied satisfaction of careers.

The results from this form could give another indication of constraints both personal and professional as viewed by the teacher. A copy of this questionnaire is contained in Appendix B.

Organizational Study (Form IX)

The final instrument in this series is a modified Q-sort composed of sixteen statements about Nova. The teachers are asked to rank each statement from 1 to 16 where a "1" identifies the statement which best describes Nova. The teachers are then requested to rank these same statements by number under the heading, "The Way Things Should be at Nova." This instrument may also be found in Appendix B.

The five questionnaires presented here are designed to collect information on teacher satisfactions, contacts, expectations and feelings about the Nova system. Data on these forms is currently being gathered and should be ready for the proposed Phase II.

Summary

The purpose of this project is to gather extensive data on the teaching system at the Nova Educational Complex with emphasis on the systems management characteristics of the system. The instruments used to gather these data concentrate on the teacher and include:

1. Two companion instruments, whose emphasis is on a functional analysis of the activities of the classroom, called RO_1 and RO_2.

2. The Flander's Verbal Interaction Scale (VIS).

3. The Multidimensional Analysis of Classroom Interaction (MACI).

4. Interviews, diaries, and records of school meetings.

5. Five instruments from an independent organizational study of the teachers at Nova.

Chapter III

CHARACTERISTICS OF

THE INSTRUCTIONAL SETTING

Introduction

Various aspects of the Nova schools tend to be unique to the educational world. Some of these aspects, together with the general support, facilities are discussed in this chapter to permit the reader to gain a better understanding of the setting in which this study has taken place. Chapter I discusses the history and philosophy of the Nova schools and provides a background to the discussion in the present chapter. Additional information about the schools is contained in Appendix A.

The information contained in this chapter has been taken principally from various materials prepared by the Nova Schools, from interviews with various staff members, and from the written comments made by the observers. The intent in this chapter is to present as objectively as possible the various characteristics of Nova. No value judgements about the worth of these characteristics are intended; the project staff made no attempt to systematically evaluate these aspects of the Nova Schools.

A Description of the Learning Activity Package

In Chapter I general approaches to individualized instruction were discussed. Individualized instruction at Nova is accomplished through the use of Learning Activity Packages (LAPs) which also were briefly mentioned in Chapter I.[1] The LAP is basically a management system for learning which allows the student to proceed individually through various learning experiences. Each LAP contains a variety of materials and activities from which each student can make personal selections. Incorporated also are opportunities for pre-testing which permit the student to by-pass areas in which he already has competency.

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[1]Discussions of the LAP are contained in the following references:

Jan McNeil and James E. Smith, "The Multi's at Nova." Educational Screen and Audiovisual Guide, January, 1968, pp. 16 - 19, 43.

Arthur B. Wolfe and James E. Smith, "At Nova, Education Comes in Small Packages," Nation's Schools, June, 1968, pp. 48 - 49, 90.

As conceived, the LAP gives students greater responsibilities and opportunities than they had previously for learning on their own. The ideal LAP contains a carefully planned series of learning activities that leads the student through relevant educational experiences. The ideal LAP contains a well defined rationale for the selection of the particular concept or major theme covered, a range of behavioral goals, opportunities for self-assessment, and teacher evaluation inventories.

Ideally, the student progresses through a set of learning activities in the LAP at a pace unique to him and at a depth that is consistent with his ability. When the LAP is used as originally intended, the slower student will not have to keep pace and the brighter student will not have to wait for the class.

The evaluation of the student's progress is accomplished by providing opportunities for student self-assessment and opportunities for teacher assessment. Students are evaluated at pre-set points in the LAP and usually different students will reach these points at different times.

In the ideal LAP, the learning activities are ordered to involve the student in experiences built around a central theme or concept. The concepts can range from simple to complex and collectively they define the scope and sequence of a given course. The student in each successive package should be able to build upon and utilize the experiences which he has had prior, packages in that course.

The format of the LAP consists of (1) the rationale which explains why the LAP was developed; (2) the instructional objectives of the LAP; (3) the self administered pre-test which enables the student to determine if he already has the competencies required; (4) the references which include the textbooks, films, tapes, and other material to be used; and: (5) the activities in which the student engages such as discussions, reports, and in-depth studies.

The ultimate goal of individualized instruction is to provide optimum opportunities for each student to achieve at a rate and level commensurate with his own ability and interest. The LAP attempts to do this by giving the students responsibility and opportunity for learning on their own. The ideal LAP contains a carefully programmed series of learning activities and contains many points where the student must make decisions as to the content he will study, the media he will use, the type of activity in which he will engage, and the mode of instruction which he prefers.

Frequently, more traditional systems of instruction expect all students to learn from a single mode of instruction or from a given media. In contrast, the LAP attempts to use a lateral approach to mode, media, activity, and content. Some students accomplish a specific goal through small group discussion while others may accomplish the same goal by working individually, by viewing a film, by playing a game, or by talking to the teacher.

The Teacher and the LAP

According to information prepared by the Dissemination Office at Nova High School, the designers of the LAP intended that the teacher be a planner of the learning activities. In addition, they want him to be a resource person, a counselor, a specialist in small group dynamics, and an administrator of the learning environment.[2]

The LAPs are written by the teaching staff at Nova which accounts for the expectation that the teacher be a planner of the learning activties. If the teacher is to write LAPs as intended, Wolfe and Smith point out that:

> The teacher is required to possess an authoritative knowledge of pure content. He must comprehend the scope and sequence of his discipline. Also the teacher must understand how children learn. He must comprehend basic psychological principles. Further, he must be able to choose a wide range of materials including books, magazines, films, and slides. The teacher must state his goals in behavioral terms, plan learning experiences in relation to what is known about learning, read and view a great wealth of materials and "cut and paste" these materials into a continuous curriculum.[3]

As Wolfe and Smith point out, "this role is a difficult one."

In some cases the teachers are given time from their regular assignments to prepare LAPs; in other cases, teachers write LAPs in addition to their other duties. At least a few teachers complain that there is no directed study of the construction of the LAPs and that they are expected to learn to become textbook authors as they write. However, the administration has prepared several papers on the construction of the LAP which can be used by the teachers. One teacher in the Technical Science department has written a LAP to explain to the other teachers how to write a LAP.[4]

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[2]Arthur B. Wolfe and James E. Smith, "Learning Activity Packages." The L.A.P. at Nova. Mimeographed booklet prepared by Nova High School, 1968, pp. 1 - 8.

[3]Ibid

[4]Lenora Malavenda, The LAP, Mimeographed, Nova High School, 1968.

After the LAP is written, the teacher in the classroom must fulfill the other role activities described above. Wolfe and Smith say:

> " First, he is available to the individual student as a source of information. He serves as a subject-matter specialist. Second, the teacher works with small groups of students. He is conscious of the subject-matter task that needs to be accomplished, but he is also sensitive to the processes of small groups. Third, the teacher helps guide the students through the set of learning experiences in the Learning Activity Package. The subject matter is matched with individual student needs, abilities, and interests. Fourth, the teacher is an administrator of the learning environment. The time to be allocated, the technology available, the facility most appropriate, and the staffing pattern most suitable for various activities must be considered and continually adjusted by the teacher."[5]

These roles envisioned for the teacher are ambitious. The correspondence between the envisioned classroom role and the actual role as observed is in part covered by the findings of this study discussed in Chapter IV. No attempt was made to study the teacher during LAP writing activities and no systematic study was made of the quality of the LAP prepared.

The LAP in Use

The LAP usually parallels the ideal structure outlined in the preceding paragraphs. Sometimes, however, the objectives are not clearly stated and sometimes the tests are loosely constructed and do not relate directly to the objectives. In some LAPs, all students are tracked through the same media and activities instead of through individually selected ones. In some cases, LAPs tend to provide linear approaches to the subject matter emphasizing the sequence rather than the scope: in other cases, LAPs provide a wide coverage of the material and emphasize scope rather than sequence.

In practice the LAP sometimes falls short of the ideal (as is to be expected). There is a tendency at Nova High School to create LAPs which contain enough material for the "average" child for about 16 days of schoolwork. This approach assumes that the "average" child will complete about nine LAPs a year. In practice this average length of the LAP is sometimes used as the criterion for student progress even though the length of the LAP is arbitrary and not empirically derived. Occasionally teachers seem to expect all students to complete every LAP in 16 days. This, of course, is contrary to the work-at -your-own-pace philosophy espoused.

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[5]Wolfe and Smith, Op. Cit.

One deficit frequently reported about the LAP is that it fails to help the slow student. Teachers say that the LAPs are geared to the good student--especially the better readers--more than they are to the slow student. Some teachers even say that it is useless to have the slow readers use LAPs and some report that there are slow students who never get through a LAP. The school, of course, is aware of this problem. In an interview, one of the supervisors said, "One of the major problems we have is writing approaches for slow learners and slow readers." He reported other efforts to correct the problem in the incorporation of lower level books into the references in the LAPs.

While the LAP is lauded by the Nova Schools, and is identified with them, not all teachers at Nova use LAPs in their classes nor do all teachers write LAPs. While some teachers say that they are under administrative pressure to write LAPs, other teachers say that they refuse to either write or use LAPs. Some teachers say that the LAP is a constraint upon their personal teaching freedom. For example, one teacher in the elementary school said that he tries to get away from the LAP because he believes they are too structured. (One number of teachers and classes in the sample who used LAPs during the classroom observations is reported in Chapter IV).

Another problem associated with the use of the LAP is the individualized testing. Normally, the students take a test (if required) at the end of a LAP in the Testing Center (which is described later in this chapter). However, some teachers say that oral examinations are necessary because the test items are common knowledge among the students throughout the high school. There was no direct evidence collected indicating whether or not the students do know the test items prior to testing, but at least some teachers are convinced enough to modify their behavior.

No formal attempt was made to collect student data of any kind in this study and only rarely were students in a position to express their opinions to the project staff. Consequently, little is known regarding the opinions of most of the Nova students about the LAP. Some teachers report that many students find it difficult and boring to sit and read LAPs for long periods of time. Of course, if the LAP employs a variety of media and activities, students should rarely have to just sit and read. While many students may like the LAP, one girl made the following comments regarding the LAP in a study unrelated to the Teacher's Role Project:

> "As a student of Nova High, I have already become acquainted with the learning activity package, and in my opinion it is a pretty poor substitute for teachers. I do not care to look in my "lap package" to answer a question, that needs more than black and white letters. A teacher is a person that teaches but also learns from his students, and a student is a person that learns and also teaches from and to his teachers. A lap package is a sorry way for teachers to hand over their knowledge to their students."

These comments should not be considered as representative of the Nova students. Many of the students undoubtedly like the LAPs and while the actual percentage is not known, they may well be a sizeable majority. Yet, this girl's comments clearly point out that there is not universal acceptance of the LAP.

In summary, the model of the LAP is one which requires and utilizes individual differences primarily through the mechanism of permitting students to make decisions. The LAPs as used are patterned after the model but frequently only approximate it. Falling short of the ideal is to be expected and the discussion of how the LAP differs from the model is meant only as a statement of reality. The intent of this section is neither to praise nor to degrade the LAP; the intent is merely to describe as objectively as possible what is there.

The Guidance Department

In an innovative, individualized educational environment, it is appropriate to look at the role of the Guidance Department, since by its nature, the Guidance Department provides individualized attention to students. Because of the various ways in which the Guidance personnel work with students, any consideration of a change in the role of the teacher must be made in view of the functions performed by Guidance.

In examining the role of the Guidance Department, both department members and teachers were interviewed. Much of the information in this chapter was obtained directly from those interviews.

The High School Guidance Department is composed of a Director and five counselors, all of whom have had teaching experience and are certified in guidance. This constitutes a student-counselor ratio of 500 to 1.

Specialization of guidance activities exist to different degrees in Nova High School, depending on the area involved. Three or four of the counselors concentrate in educational counseling (e.g., schedule and program selection, college placement) although all members of the department work as educational counselors. The majority of vocational counseling is done by one person who has concentrated in this field, although again, all members of the department do vocational counseling to a limited degree. Psychological counseling is not done within the department. If an assessment is made that a student may require psychological attention, he is referred to a county operated diagnostic clinic located in an old elementary school.

Staff advising is practiced by every member of the department in that each counselor is assigned to an academic department as well as a grade level. In spite of this grade level assignment, the pertinent counselor does not service all members of that grade; however, if a parent makes an inquiry about a student, the parent is referred to the pertinent counselor. Social workers are not extensively used, in that there is very little truancy at Nova.

There are a number of traditional guidance services offered at Nova only on a minimal basis. This is attributable more to the peculiar circumstances of the Nova system rather than to any deficiency on the part of the department. For example, guidance of adolescent dropouts is not particularly prevalent in that there is a low number of dropouts. There are many more transfer students than dropouts--students who can't adjust to the Nova program. These are usually students in the seventh, eighth, or ninth grade.

The Guidance Department also does only a minimal amount of vocational guidance and vocational employment since most of the Nova students go to college. In 1968, 95% of the Nova students went to college; 64% went to four-year colleges or universities and 30% went to junior colleges. There are a limited number of students in a vocational training program who work approximately half a day in school and half a day in vocational situations, training for such positions as medics, hotel assistants, etc. This program is started in the junior year.

In relation to post-graduation employment, last year the Technical Science Program provided three students with jobs. These students were able to get their complete training at Nova High School. All were in the program and in Nova High School from seventh through twelfth grade. Last year, these students went into either Graphic Arts or the computer field.

There is no psychological counseling done on the premises because of the dearth of trained psychologists. Occasionally, a psychologist comes from the Diagnostic Center to test a student at Nova but the majority of the time, the students whom the guidance counselor feel are in need of help are sent to the Diagnostic Center for testing. If the Center recommends psychiatric help, the student is referred to a psychiatrist if his family can afford the expense. If not, the student is sent to the Henderson Clinic. The Henderson Clinic is a public service organization located in Fort Lauderdale which charges according to financial capability. It is predominately staffed by intern psychologists. For the most part, the guidance counselors do stay in touch with the psychologists to whom the students have been referred.

Group counseling exists only on a limited basis. Students in their seventh year are counseled in groups of fifteen, in homogeneous groupings. In these groupings, which occur over a seven-week period, the counselors attempt to orient the students to the school programs and the school philosophy as well as attempting to develop adaptive study habits.

Group counseling related to college preparation and college placement provided for students in the tenth, eleventh, and twelfth grades.

These sessions are usually held at the beginning of the year for seniors, and at the end of the year for juniors and sophomores. The Guidance Department meets with the prospective college students for an approximate total of seven sessions. A large proportion of the department's efforts is in the field of college placement and guidance. All of the counselors are trained in college placement and work extensively on this facet of guidance. The department attempts to prepare students to take the college placement or entrance exam. Writing recommendations for college also is a frequent counselor activity.

In relation to high school educational guidance, each spring, each student makes out a schedule for the following year. This is more complicated at Nova than at many other schools because the students, having a form of individual pacing within modular scheduling might be working in different subjects at different grade levels. Each of the counselors is assigned a group level and each student is interviewed and his schedule is reviewed with the counselor. It was noted that the parents have to sign these schedules and many times after a student-counselor conference, the schedules are changed by the parents.

The department is primarily client-centered and non-directive. Members of the department are in contact with parents, the administration, and the department supervisors. One guidance counselor interviewed indicated that he spent a great deal of time with the parents but that he usually did not contact the parents until he and the student agreed that this should be done. The students apparently feel free to walk into the guidance office and discuss the topics that bother them. The Guidance Department seems to strictly orient toward an open situation with the student. One counselor mentioned that he saw from thirteen to seventeen students a day. Apparently, the Guidance Department attempts to help with the student's problem, whether it's a bad home situation or an unrelated school difficulty.

The High School Guidance Department works with the Administration. However, many times the Administration refers a student to the Guidance Department after the student has been expelled or suspended or has served his penalty. Members of the Guidance Department have said that they believe it would be advantageous to see the student before this time.

The academic department supervisors and the Guidance Department also work together in individual counseling. If a counselor is approached by students with problems which could be better handled by a departmental supervisor, the student is sent to the appropriate supervisor. For example, a student went to the Guidance Department to drop mathematics. The Guidance Department had no authority to let him out so he was sent to the Mathematics supervisor. Although, the Guidance Department has joint planning activities with the administration and with the teachers, communication between the teachers and the Guidance Department does not appear to be optimum.

The Guidance Department at Nova High School administers a general tenth-year aptitude test and the Florida Statewide Grade Tests to the students. The Guidance Department has such tests available as the Wechsler Intelligence Scale for Children (WISE), the Otis Quick Scoring Mental Ability Test, the Stanford Achievement Test (SAT), the Gates Reading Survey, the Kuder Preference Record, and the California Interest Inventory. These tests are available to the Administration for students on an individual basis. There is one person in charge of testing, who has a masters degree in testing and measurement and is certified in Guidance as well. The tests are interpreted for the parents or the students if the Guidance Department thinks it appropriate. In other words, the grades or results are usually distributed selectively. The raw scores are seldom released. Personality and interest inventories are only used in individual counseling.

The Guidance Department also makes an attempt to follow the college performance of those students that have gone through the Nova system. The Department indicates that some of the colleges refuse to send the information because of parents and/or student reservations. In the follow-up program, the general feedback indicates that students who graduated from Nova seem to be making an above average academic adjustment in college as judged by their grades.

The information service is maintained by a secretary and a registrar who keep files on colleges, vocational and placement guidance. There is a room provided for the students which seats fifteen or twenty. The students can go through the material at their liesure. The High School has catalogs from nearly every college in the country, selected college yearbooks, catalogs which cite college acceptance requirements such as the ACAC catalogs, all the Lovejoy vocational and educational guides, and the Burrough's Study Guides in the vocational field. Also the High School sponsors programs in which representatives from colleges talk to and interview students.

Testing Centers

In Nova High School, the majority of academic progress testing is done in central departmental testing centers. This is significant in that this organizational procedure individualizes education to the extent that it allows individual pacing. A student is able to go to the test center when he is ready for testing, in contrast to the traditional situation in which all students are asked to cover the same material at an identical pace and be tested on material simultaneously.

Each test center varies slightly in its practices, but the general testing procedure is reflected by the Science Department Test Center pattern. The student gives the test center supervisor, usually a teacher's aide, a form from the appropriate teacher and in return, is given a test and a test card. In general, three or four forms of a test are possible. In some instances, test questions are typed on file cards and shuffled, as one would do with playing cards, to get multiple test combinations. The student takes the test and when finished, gives the test and test card back to the aide. The aide then returns the student's form signed,which the student returns to the classroom teacher.

The tests are usually corrected by clerical help or teacher's aides; who use a standard key and grade the test according to a key. However, the teachers retain the option of the final grade.

In practice it appears that the testing center may not have freed any of the teacher's time. In theory, a student takes a test when he feels ready to do so. Actually, much of the teacher's time is spent evaluating the student's readiness to take the test and granting or refusing him permission to do so. Additional time is spent either discussing test results or the student's achievement on the test, giving feedback to the child about his actual grade, maintaining the system of pupil accounting, etc.

The actual grading feedback procedure varies from department to department. In some cases, test grades are posted; in others, they are kept in folders in which the students may look; in other situations, they are kept on cards, etc.

The High School is now in the process of establishing a central testing center which will be used by all departments except English and Foreign Languages. There will be a teacher in charge of this common testing center.

The Resource Center

In Nova, the traditional library is replaced by five separate resource centers, each located in the central part of the Language-Arts, the Science, the Mathematics, the Technical Science,and the Social Studies buildings, with adjoining conference rooms. This distribution was intended to place the pertinent materials closer to the area of study, thus increasing the accessibility of the instructional materials.

Each resource center has carrels which are for individual study, typing, audio, and television. The audio carrels are student operated, with the student able to dial for a language tape, a lecture tape,or a musical program. The television carrels are operated from the circulation desk, where the programs are called in directly by telephone to the television center.

The Nova resource centers have,as an additional feature, an information retrieval program. Materials which are to be preserved are given to the resource director by the teacher so that they may be placed on microcards. After being microfilmed, the cards are coded and sent to the data processing offices to be key punched. When the cards are returned, they are ready to be viewed by the students on the microcard readers.

The largest resource center, which is in the English-Social Studies building, contains the master card catalogue, which lists the holdings of all five centers. The Nova resource centers have all the customary properties of a library, e.g.,periodicals, Readers guide, vertical files, etc.

A reader-printer is also available, as is a microfilm reader, which is used primarily for reviewing back issues of periodicals. A Vico-matic Copier is located in the Language Resource Center for the convenience of those who wish to reproduce printed material.

Non-Instructional Personnel in the Classroom

The Nova Schools provide teacher aides to assist teachers in all three schools. The high school's 1965-66 faculty report recommended that the school utilize fully the talents and time of instructors by providing aides and clerical assistance. During the time of this study, many aides were employed by both the high school and the elementary schools.

In Broward County, the School Board considers a teacher aide to be a member of the non-instructional staff. This is imposed upon the system by a Florida Statute which provides that no one may serve in an administrative or instructional capacity as a regular or part-time teacher who does not hold a valid certificate to teach in Florida. This legal position, then, limits the duties which the teacher aide can be given.

Within the provisions of the law, a non-certified teacher aide seems to be prohibited from :

(a) instructing pupils in any manner;
(b) assuming sole responsibility for the class;
(c) grading papers which require subjective evaluation by the teacher;
(d) assigning actual grades on papers, tests, or in a subject area;
(e) administering discipline; and
(f) conducting special classes for exceptional groups.

Many of the duties which the aide can assume must be conducted under the immediate direction of a teacher.

In the elementary schools, an aide is assigned to each suite (instructional division), but the teachers generally say that more aides are needed. The aides are used on mathematics, spelling, and reading with the pupils in small groups under the general direction of a teacher. Also they are used in traffic control activities during the movement of children in the building.

In the high school, teacher aides are allocated to the different departments on the basis of need--which the departments must demonstrate. The aides in the high school spend much of their time grading tests, recording scores, making out absentee lists, and similar clerical tasks.

In addition to the teacher aides, volunteers are used extensively at Nova--especially in the elementary schools. Usually mothers, the volunteers number almost 300 in Nova I and Nova II combined. Many of these women help in the resource centers where they serve as story ladies, checkout clerks, typists, and equipment operators as well as in other capacities. At Nova II, some of the volunteers operate a paperback bookstore. In the classroom, the volunteers help the teacher by guiding first year students in reading readiness activities, changing records at listening stations, taking children to and from the classroom, and by performing many similar tasks. In general, the teachers and administrators say that without the volunteers, it would be extremely difficult to operate the school.

Equipment and Physical Plant

Described below are some of the more characteristic physical features of the Nova Schools:

The actual plant of Nova High School and Nova I Elementary cost $15.00 per square foot as of August, 1968. This includes such features as air conditioning and the closed circuit television system. The different disciplines in the high school are located in separate buildings, e.g., Math in the Math Building. These buildings generally contain classrooms, a resource center, conference rooms, teacher planning offices, and clerical and administrative offices. The flexibility of the appointment of both the high school and Nova I Elementary enables the teacher to group students in whatever combination the teacher deems most effective. There are rooms with equipment for large group instruction with seating capacities of from sixty to one hundred, small rooms for small group discussions, even smaller alcoves for independent study, folding doors in some teaching stations, and moveable tables and chairs.

Teacher planning rooms are placed away from the regular commerce of education, where the teacher may work relatively undisturbed. The conference rooms are generally removed from the classrooms, and have doors which may be closed shutting out all extraneous noises. They serve as either a place where students are able to study without interference or where teachers are able to hold small group discussions. Moveable furniture within these rooms permit multiple arrangements.

Another feature in the high school is the Language Laboratory, which has multiple listening carrels for the foreign language students. LAPs are not used in the Language Department, but the audio-lingual method of instruction is, particularly for the modern languages, which places great emphasis on the use of this equipment.

There are large lecture rooms such as the Social Studies Lecture Hall, in which the teacher has an elevated platform from which to lecture, with such equipment as an overhead viewer, movie projector, a screen which is located behind the platform, tape recorders, a microphone, amplifiers, maps, globes, etc. The furniture is moveable, so that various patterns convenient to the needs of the student may be structured.

In addition to the traditional science lab features, one of the classrooms in the Science Department has a television set, a blackboard adjustable to height, the room partitioned off from the next class by a soundproof partition, and a movie screen built into the ceiling.

Audio-visual equipment is also much in evidence. Over $200,000 has been invested in the closed circuit TV system. Filmstrip projectors, tape recorders, overhead projectors, record players are all relatively plentiful, with an opaque projector available in the Math Resource Center.

Nova I also is patterned much like Nova High School, except contained in a single structure. The Resource Center has audio-visual equipment, storage space, number of books, television sets, slide viewers, and record listening devices. The Science Laboratory is well equipped and spacious with sinks, burners, and storage room for equipment.

Many of the classrooms, again, have folding partitions, which may be pulled back. When the partitions are not drawn, four or five teachers and aides may be engaged in instruction simultaneously. The furniture is usually moveable and varies in size allowing group or individual work. The audio-visual equipment, particularly record players, is also in evidence.

Nova II provides somewhat of a contrast to Nova High School and Nova I. Nova II is a two story building over fifty years old, of old Spanish architecture.[6] It is a building which is cold in the winter and very warm in the summer since air conditioning is not provided and the heating is inadequate. The building is stucco with wooden floors, and large sash type windows. The lighting is generally poor and there is, on the average, one electrical outlet per room.

The existing mechanical teaching aids are comparatively sparce. The Resource Center has an overhead viewer, only a limited amount of bookshelving, slide viewing devices, and carpeted rooms which deaden the noise somewhat. There are carrels which have seating facilities for half a dozen children, but only one recording and listening device. The main corridor of the main building is adjacent to the Resource Center main room, which makes it very noisy. It is impossible to close the doors in the hotter weather as the heat becomes stifling.

The Science Laboratory, in contrast to that in Nova I, is a room arranged with plain tables, limited plumbing, and few sinks and electrical outlets. Since storage space is almost nonexistant most of the equipment is exposed at all times. The classrooms are also limited by the fact that desks cannot be moved with ease, lighting is poor, circulation of air on the second floor is poor, and storage space is at a minimum and materials are stacked in the room. There are usually blackboards, makeshift bulletin boards, and a record player and listening phone in evidence.

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[6]At the time this report is being written, a new building to house Nova II is being constructed adjacent to Nova I.

The Practical Arts classroom, formerly a Home Economics classroom, has old and non-operable stoves filling up valuable space. The shelving is inadequate, therefore, most of the materials are left out in the open, where the children have access to them. There are no guards or screens around the power machinery. The courtyard of Nova II, between the wings of the main building, is often used as an open class.

There _is_ one small structure, the ITA Building, which is air conditioned. It is circular in shape, and has a movie screen, an overhead viewer, moveable chairs, etc.

Chapter IV

AN ANALYSIS OF TEACHER MANAGEMENT FUNCTIONS

Introduction to the Analysis

A basic premise of the project is that the classroom management characteristics of the teacher's role are extremely important to the success of the teacher in achieving the objectives of the educational system. The extensive data which were collected during Phase I of the project are primarily concerned with the teachers' management behaviors and various analyses of these data were undertaken in order to adequately describe those management behaviors. The analyses reflect the descriptive nature of the project and do not attempt to establish causation although possible causes of particular phenomena are discussed.

Chapter I of the report establishes the systems approach of the project. Within the framework set forth in that discussion, the analyses have concentrated on the teaching subsystem as a process. In particular, the classroom functions and activities of the teacher have been examined.

Several different approaches were used in analyzing the data and include statistical comparisons, summary tables, and written descriptions. Comparisons range in level from comparing the schools within the complex to comparing observations made on the same teacher. It should be emphasized that because of the extent and nature of the data, additional analyses could be made to answer additional relevant questions. It would have been impossible within the scope and duration of Phase I to have looked at the data in all possible ways. However, the approaches which have been used contribute extensively to the description of the teacher's classroom behavior at the Nova Schools.

Throughout this Chapter, and the rest of the report, care has been taken to protect the anonymity of the teachers. All identifying information has been changed or deleted.

While in some instances, descriptions would be improved with the addition of more information, it is more important to protect the rights of the teachers.

Design Considerations

A primary concern in analyzing Phase I data is to detect the unique role behaviors associated with (or affected by) the innovative, individualized aspects of the Nova Schools. Since Nova is in a transitory period encompassing both traditional group teaching and individualized teaching, it should be possible to isolate those activities of the teacher which are a function of the situation in which he teaches. At the simplest conceptual level, teachers in classes utilizing Learning Activity Packages (LAP) should exhibit a different pattern of behavior than teachers in lecture classes. The problem of discerning such different patterns, however, is not simple because the situations in which the teachers teach are confounded by many variables besides those associated with the method of instruction.

The primary sample of teachers was randomly selected within each high school department and within each of the two elementary schools and is approximately proportional to the overall size of each of these units (see discussion of the sample in Chapter II). Thus, the only variables directly involved in sampling were the subject area (department) and the school (Nova I and Nova II). To compare the role behaviors of teachers in LAP classes versus those in non-LAP classes, and then to conclude that particular behaviors are a function of the LAP usage, would require the assumption that LAP usage is distributed evenly across other relevant groupings such as departments. However, the evidence would suggest that LAP usage is anything but random across the other factors. For example, the observations show that the Science Department uses LAPs almost 100% of the time while the Language Department uses virtually no LAPs. Consequently, comparison of groups based upon LAP usage is strongly confounded by differences due to the substantive areas. Further, since LAP usage is correlated with departments and sex is also correlated, to some degree, with departments, sex differences in teaching also influence the comparison of LAP classes versus non-LAP classes.

The data considerations, then, suggest a Multiple Analysis of Variance (MANOVA) type design involving factors such as LAP usage, department, sex, as well as possible other factors of age, experience, and similar demographic variables. Considerations such as class size, elective versus required courses, and other class characteristics could also be included. Unfortunately, the size of the working sample is 36 teachers (most with multiple observations). Consequently, the available degrees of freedom would be rapidly used up if the sample was analyzed in a MANOVA design. Further, some cells would be completely empty if more than a very few factors were considered.

While the data suggest a MANOVA design for comparison, the sample size does not permit such a design. Because the study is descriptive (and not inferential), the data can be compared in almost any type of design without losing meaning. However, it is desirable to isolate the sources or correlates of as much of the variance as possible, even in a descriptive study. In the analyses which are described below, obvious confounding has occurred which prevents as fine a description as would be desirable. This confounding has been kept in mind throughout the analyses and their interpretations.

INTERGROUP COMPARISONS

1. Selection of a Measurement for Comparisons

The quantitative data collected on the RO_1's is primarily the time and frequency of overt, observable behaviors. Descriptively, it is of interest to determine the differences which exist between various groupings of teachers in the overt behaviors which they exhibit. For example, (as mentioned above) it is of interest to determine how the behaviors of teachers in LAP situations differ from the behaviors of teachers in non-LAP situations. Also, other comparisons are of interest and are described below.

Thus, keeping in mind the design problems discussed above, it was decided to statistically compare various groups on the RO_1 data. The two basic summary measures readily obtainable from the RO_1 data are the total frequency of occurrence of an event during an observation and the total time involved in the occurrence of an event for the observation. To equate for time discrepancies among different observations, both the frequency and the time can be expressed in percentages of the total for each observation. Thus, it can be stated that for Teacher A, 4.3% of his time was involved with Event 1703 and 3.2% of all events recorded for him were Event 1703.

For intergroup comparisons, both percent time and percent frequency have advantages and limitations. The chief limitation on time is that it was noted only to the nearest minute during an observation. For example, the observer might record the time as 9:22 to 9:23 for six events when one of them lasted thirty seconds, and the other five each lasted six seconds. The main limitation with frequency is that it does not denote how much of a teacher's time was involved in a particular activity, but only how many times he engaged in it. Teacher A might have a frequency of one for a particular event although he spent five minutes completing it, while Teacher B could have a frequency of ten for the same event although he spent only two minutes on that event. These limitations were considered and it was decided that the percent of time a teacher engaged in an event was a more meaningful measure than the number of discrete times he did it, even though time, in this case, is a less accurate measurement. Consequently, precent time was chosen as the primary measurement to be used to compare groups. Procedures for calculating time are discussed in a following section.

2. A Priori Group Comparisons

Several between-group comparisons are of interest in this study and as discussed above these comparisons could best be made in a MANOVA design if the sample size was large enough to permit such a design. Since MANOVA is not feasible, it was decided to compare various a priori groupings of teachers (RO_1 data) using a discriminant function analysis. A discriminant function computer program prepared by Veldman[1] was modified for use at Nova University and was used for all discriminate analyses. Since the raw data was not directly suitable for use in a discriminant analysis, several processes were required to modify it. These processes are described in the section entitled Data Reduction.

The a priori groups which are of the most interest are the LAP users and the non-LAP users. Unfortunately, these groups are not always discrete nor independent. In some instances, a teacher uses LAPs in one class but not in another. In other cases, LAPs are used with part, but not all, of a class; that is, some students use LAPs for part of the period, but not all of it. Also, a combination of these possibilities can be present. In technical science classes, in particular, various pieces of equipment such as typewriters and electronic apparatus are used in conjunction with LAPs.

Based on these considerations, four logical groupings emerge. These are:

a) LAPs--classes predominately using LAPs.

b) Traditional--classes not using LAPs and in which the teacher usually interacts with all members of the class at the same time.

c) Non-LAP-Individualized--classes not using LAPs, but in which the teacher interacts with students individually or in small groups.

d) Mixed--classes partially using LAPs either in terms of time or number of students or consisting of some combination of the activities which characterize the other three groups.

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[1] Donald J. Veldman, Fortran Programming for the Behavioral Sciences, New York: Holt, Rinehart and Winston, 1967.

These four groups are used for discriminant analyses (as well as other analyses) to discern the differences which occur among the various instructional modes of the classroom.

Table 4-1 illustrates the differences in approach among the four types of classes, based on the size of the group with which the teacher interacts. The figures in the table are based on the percentage occurrence of interactions for various sized groups; only the median, the high, and the low percentages for these groups are reported. Some interactions took place with groups of students larger than six but smaller than the whole class. These, however, are few in number and are not reported. In the high school, the median percent of interaction with the whole class is only 3.0% for LAP classes but it is 50.5% for traditional classes. The median of the Non-LAP Individualized class is 4.9% which reflects the individualized aspects of it. The Mixed situation has a median whole-class interaction of 35.7% which tends to reflect that it is comprised of classes which have elements of the other categories.

The interaction of the teacher with single students also reflects the nature of the various situations. LAP classes have a median of 83.8%, Non-LAP Individualized classes have a median of 63.2%, Mixed classes have a median of 51.4%, and Traditional a median of 33.3%. Thus, there tend to be many more individual students interacting with the teacher in the individualized classes than in the traditional ones. None of the situations seem to have a very high incidence of teacher interaction with small groups, even though small groups are frequently considered to be an important part of individualized classrooms.

The figures for the elementary schools are distinctly similar to those for the high school except that there were no Mixed situations observed in the elementary schools. The table reveals that both the high school and the elementary schools are similar in the relative occurrence of different types of student-teacher interactions and the four teaching situations are comparable in terms of interactions across the schools.

Table 4-2 shows the distribution of RO_1 observations in each of the four teaching situations across the six high school departments and the two elementary schools. As mentioned above, all the Science observations are LAP situations and all the Language observations are traditional. The other divisions are evenly distributed across the four situations, except that Nova II has neither LAPs nor Mixed situations included in the observations. It should be emphasized that the distributions presented in Table 4-2 represent only the RO_1

NOVA HIGH SCHOOL					
		LAP (1)	TRADITIONAL (2)	NON - LAP INDIVIDUALIZED (3)	MIXED (4)
WHOLE CLASS	Median	3.0	50.5	4.9	35.7
	High Score	32.7	89.4	74.2	55.0
	Low Score	0.0	0.5	0.0	0.8
SINGLE STUDENT	Median	83.8	33.3	63.2	51.4
	High Score	98.7	75.8	95.7	96.8
	Low Score	40.0	6.9	25.7	30.1
SMALL GROUP (2 - 6 Students)	Median	1.2	0.6	1.6	0.8
	High Score	25.6	16.8	34.8	8.8
	Low Score	0.0	0.0	0.0	0.0
NOVA ELEMENTARY SCHOOLS (I and II)					
WHOLE CLASS	Median	3.7	55.9	3.8	None Observed
	High Score	35.4	92.1	43.1	"
	Low Score	0.0	3.8	0.0	"
SINGLE STUDENT	Median	75.8	36.0	65.4	None Observed
	High Score	96.8	78.2	98.7	"
	Low Score	51.1	5.2	33.3	"
SMALL GROUP (2 - 6 Students)	Median	10.3	3.2	1.6	None Observed
	High Score	22.0	19.7	23.7	"
	Low Score	3.1	0.0	0.0	"

MEDIAN PERCENTAGE OF TEACHER INTERACTIONS WITH

SINGLE STUDENTS, SMALL GROUPS, AND THE WHOLE CLASS

Table 4 - 1

INSTRUCTIONAL DIVISION	SUBJECT	TEACHING SITUATION				
		LAP	TRADITIONAL	NON-LAP INDIVIDUALIZED	MIXED	TOTAL
HIGH SCHOOL:	Science	11	-	-	-	11
	Math	6	3	3	2	14
	Tech. Science	3	3	3	3	12
	Social Studies	2	3	2	2	9
	English	3	5	1	3	12
	Languages	-	9	-	-	9
ELEMENTARY SCHOOL	NOVA I	14	7	6	-	27
	NOVA II	-	3	9	-	12
	TOTAL	39	33	24	10	106
	Percent	36.8	31.1	22.6	9.4	-

DISTRIBUTION OF OBSERVATIONS BY TEACHING
SITUATION AND INSTRUCTIONAL DIVISIONS

Table 4 - 2

observations used for analyses in this report. Absences in particular cells in the table do not necessarily mean that the particular situation is absent from that instructional division.

The cells in Table 4-2 are not independent. Twelve or one-third of the 36 teachers in the sample have observations in two or more of the situations. This factor occasionally limits the analyses which can be used with the data since statistics such as Chi Square assume independence among the cells.

A second type of comparison is also suggested by the fact that some teachers teach in both LAP and Non-LAP situations. A comparison between a teacher's behavior in the two situations should give a good indication of which differences are attributable to the instructional method. However, the number of teachers included in the sample for whom data is available in both situations is small and does not permit statistical analysis. In analyses, where it is particularly pertinent, comparisons between observations in different situations on the same teachers are discussed.

Comparisons among the six high school departments (excluding physical education) and the two elementary schools were undertaken to indicate some interdisciplinary differences, but as previously discussed the comparisons are confounded, especially by the use of LAPs.

3. Data Reduction

a) The Need for Data Reduction

The raw data provided provided by the RO_1 consists of event times and sequences (as well as the descriptive information regarding the event), which are not directly useful in a discriminant function analysis. As previously discussed, the percent of time each event occurred was selected as the measurement which seemed to be most descriptive of the teacher's behavior. A computer program was written to tally and summarize the data for each observation. A sample printout is presented in Table 4-3 and the methods for time calculation used in the program are discussed in a following section.

Since not all events were of direct interest, the program provides the option of working only with particular events as specified by the user. Consequently, there are two different totals for both frequency and time. Frequency and time can be considered for the total number of events in the observation or for the number of selected events in which there is a direct interest.

CATEGORY	FREQUENCY	PERCENT FREQUENCY (ALL)	PERCENT FREQUENCY (SELECTED)	TIME	PERCENT TIME (ALL)	PERCENT TIME (SELECTED)	AVERAGE TIME
1103	2	1.32	1.32	0.750*	1.29	1.33	0.37
1703	36	23.84	23.84	11.838*	20.41	21.13	0.32
1303	1	0.66	0.66	0.250*	0.43	0.44	0.25
1701	9	5.96	5.96	2.426*	4.18	4.33	0.26
1704	6	3.97	3.97	2.226*	3.83	3.97	0.37
1707	19	12.58	12.58	5.052*	8.71	9.02	0.26
1712	21	13.90	13.90	5.554*	9.57	9.91	0.26
1713	7	4.63	4.63	3.226*	5.56	5.76	0.46
1714	2	1.32	1.32	0.666*	1.14	1.19	0.33
1721	4	2.64	2.64	0.950*	1.63	1.69	0.23
2201	1	0.66	0.66	0.500*	0.86	0.89	0.50
2731	1	0.66	0.66	0.500*	0.86	0.89	0.50
2703	9	5.96	5.96	4.416*	7.61	7.88	0.49
2704	1	0.66	0.66	0.333*	0.57	0.59	0.33
2706	8	5.29	5.29	4.250*	7.32	7.58	0.53
2707	4	2.64	2.64	1.333*	2.29	2.38	0.33
2709	1	0.66	0.66	0.500*	0.86	0.89	0.50
2710	1	0.66	0.66	0.166*	0.28	0.29	0.16
2712	3	1.98	1.98	1.500*	2.58	2.67	0.50
2718	4	2.64	2.64	2.083*	3.59	3.72	0.52
3723	1	0.66	0.66	0.142*	0.24	0.25	0.14
3732	3	1.98	1.98	1.666*	2.87	2.97	0.55
3733	1	0.66	0.66	0.333*	0.57	0.59	0.33
7000	6	3.97	3.97	5.333*	9.19	9.52	0.88

* INDICATES TIME INCLUDES ONE OR MORE ESTIMATED TIMES

EVENTS HAVING ZERO FREQUENCY ARE NOT PRINTED

SAMPLE PRINTOUT OF COMPUTER PROGRAM TO CALCULATE
FREQUENCY AND TIME OF EVENTS

Table 4 - 3

Percent time and percent frequency can then be calculated using either of these totals. Thus, a decision had to be made to use one or the other of the two possible percentage times in the analyses and, after careful consideration, the percent of selected events was chosen for use. Within a given observation, the two percentages should be directly proportional across events since the ratio of the two totals is constant. However, across different observations the ratios vary depending upon the relative amount of time consumed by the excluded events within each observation.

Only two events with a total frequency of occurrence of five or greater across <u>all</u> observations were excluded from consideration in the general analyses. These events are 4744, "Inaudible or incomprehensible teacher response," and 5009, "RO stops observing in the middle of the observation for a period of time," (see Chapter Two). Event 4744 is assumed to be random within an observation and in the absence of contradictory evidence it is assumed that if the resident observer (RO) had been able to record the response it would be distributed randomly across the other categories in proportion to the total frequency and time for each category. Consequently, exclusion of 4744's from the total time should make the percentages more consistent across teachers, and should have no effect within an observation.

Events coded 5009, however, cannot be assumed to be random because they frequently occurred when the teacher deliberately turned off her throat microphone in order that the RO could not hear what was said. Other distractions and interruptions also were coded 5009 and some of these were probably random across categories and teachers (e.g., equipment failure). If all 5009's were a result of deliberate action on the part of the teacher they should probably be included in the analyses, but since they are greatly confounded by other occurrences, their inclusion would at best yield uninterpretable results. Consequently, 5009's were omitted from the total time used for calculating percentages. The total time used for calculating percentages then is the total time of selected events rather than the total time of the observation. In the cases where 5009's and 4744's do not occur, the two totals are identical.

The nature of discriminant function analysis imposes several constraints on the data. Statisticians advise that the ratio of subjects to variables should be reasonably high and various guidelines give figures ranging from 2:1 to 10:1. Since the sample of teachers is 36 and since there are almost 100 categories coded in the RO_1's, a major reduction was required in the number of variables to be considered by the discriminant analyses. Since the study is primarily descriptive, a minimum ratio of 2:1 was used. Thus, an analysis involving all 36 teachers could have a maximum of 18 variables. How this problem was handled is described in the following section.

Another constraint imposed upon the data by the discriminant function analyses is the assumption of normally distributed data. The degree to which data can vary from normality seems to be open to question, and in a descriptive study the requirement of normally distributed data is probably trivial. However, because the distribution of percent time is probably at best highly skewed, if not rectangular, and because it is relatively easy to normalize data with the aid of a computer, the data was normalized. The procedures involved in normalizing are discussed in a following section.

b) Reduction of the Number of Variables for Discriminant Analyses

Two basic procedures were used to reduce the number of variables so that discriminant analysis could be used. The first method was strictly empirical. The frequencies of each event were calculated across all observations and it was found that 22 events never occurred. These events were then eliminated from further analysis. Table 4-4 shows the frequencies of each event across all observations.[2]

After the elimination of the non-occurring events, the remaining events were retained, eliminated, or combined on a priori considerations. Fifteen events with a total frequency of less than five were combined or eliminated. Of these, five were dropped and the remaining ten were combined with other events (see Table 4-5).

The events which remained were then grouped into single categories, retained as discrete events, or dropped on a priori considerations. The resultant 45 categories are shown in Table 4-5. It should be stressed that the elimination and combination of categories was

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[2]The frequencies shown in Table 4-4 were obtained prior to several corrections in the data. Consequently, they may deviate slightly from the actual frequency of occurrence of each event category.

EVENT	FREQUENCY [a]	EVENT	FREQUENCY [a]	EVENT	FREQUENCY [a]
1101	13	2301	21	3301	1
1102	17	2302	1	3701	16
1103	276	2303	2	3702	0
1104	3	2304	25	3703	53
1201	14	2305	9	3704	6
1203	316	2306	9	3705	0
1204	52	2701	33	3707	2
1301	21	2702	47	3708	6
1303	125	2703	1428	3709	1
1701	219	2704	170	3711	0
1702	0	2705	1	3712	45
1703	1875	2706	113	3713	14
1704	586	2707	548	3714	0
1705	0	2708	36	3715	0
1707	461	2709	468	3716	0
1708	16	2710	334	3717	7
1709	246	2711	23	3721	0
1712	1930	2712	163	3722	0
1713	713	2713	92	3723	49
1714	202	2714	38	3724	1
1715	83	2715	43	3725	0
1716	50	2716	3	3727	3
1717	3	2717	6	3728	0
1721	682	2718	97	3729	0
1723	107	2721	3	3731	0
1731	14	2731	19	3732	21
2101	3	3102	0	3733	5
2102	13	3103	0	3734	0
2201	53	3104	0	3736	0
2203	7	3203	0	3737	1
2204	0	3204	0	7000	148

[a] This table was prepared prior to several corrections in the data. Consequently, the frequencies presented here may vary slightly from the actual frequency of events.

FREQUENCY OF OCCURRENCE OF EVENTS ACROSS 106 OBSERVATIONS

Table 4 - 4

Cluster Variable Number	CLUSTER A Category Number	Event Number	Event Code	CLUSTER B Category Number	Event Number	Event Code	CLUSTER C Category Number	Event Number	Event Code
1	1	1	1101	19	23	2102	37	50	2715
2	2	2	1102	20	24	2201	38	51	2718
3	3	3	1103	21	25	2301	39	52	2721
		4	1104					53	2701
		5	1203					54	3701
		6	1703						
		7							
4	4	8	1201	22	26	2302	40	55	3703
					27	2303			
					28	2731			
5	5	9	1204	23	29	2304	41	56	3704
								57	3707
6	6	10	1301	24	30	2305	42	58	3712
								59	3713
7	7	11	1303	25	31	2306	43	60	3723
								61	3724
								62	3727
8	8	12	1701	26	32	1708	44	63	3732
					33	2708		64	3733
					34	2714			
					35	3708			
9	9	13	1704	27	36	1716	45	65	7000
10	10	14	1707	28	37	2702			
11	11	15	1712	30	38	2703			
12	12	16	1712	30	39	2704			
					40	2705			
					41	2716			
					42	2203			
13	13	17	1713	31	43	2706			
14	14	18	1714	32	44	2707			
15	15	19	1715	33	45	1709			
16	16	20	1721	34	46	2710			
17	17	21	1723	35	47	2711			
18	18	22	1731	36	48	2712			
					49	2713			

FORTY-FIVE CATEGORIES OF EVENTS GROUPED FOR DATA ANALYSIS

Table 4 - 5

done primarily for use in the discriminant analyses. All of the categories, including those which did not occur, have significance for the descriptive study of Nova teachers and many are discussed elsewhere in this report.

The 45 categories of events still greatly surpassed the desired maximum of 18 variables for the analyses, but further elimination and combination of events would have had to be done with neither logical nor empirical basis. The variables still outnumber the subject, so remaining variables were arranged in three groups and separate discriminant function analyses were performed for each intergroup comparison. This procedure has inherent weaknesses. It is impossible to say what the results would have been if the variables had been grouped differently. The interrelationships among the variables in the different clusters cannot be readily determined. Further, by running three separate analyses, the possibility exists that the probability associated with the extracted roots is slightly misleading because of the increased alpha error associated with multiple tests.

Three arbitrary clusters of variables were formed as shown in Table 4-5. Cluster A is the 18 events numbered in the 1000's, excluding event 1708 which is in Cluster B. Cluster A consists of events which deal with the management of subject matter and cognitive acquisition. Cluster B primarily deals with events concerned with the management of systems and is comprised of the first 18 events and groups of events numbered in the 2000's. One group of events in this cluster contains events 1708 and 3708 in addition to events in the 2000's. Also event 1716 was placed in Cluster B. Two groups of events which are predominantly in the 2000's have been arbitrarily placed in Cluster C because the maximum of 18 events had been reached in Cluster B. Cluster C contains all the remaining events which are primarily those numbered in the 3000's, plus event 7000 and those left over from Cluster B.

Three discriminant function analyses were run on the data clustered as discussed above. While not an accepted, orthodox procedure, a fourth discriminant analysis was performed using as variables the best predictors obtained in each of the other three analyses. Used as an inferential technique, such a procedure is practically indefensible and certainly the probabilities associated with the groupings are extremely inflated. However, in a descriptive study, such a grouping of variables has as much meaning as any arbitrary grouping. Thus, interpretations of the loadings must assume that the sample is a population in and of itself, rather than being representative of a larger totality. The purpose of this fourth analysis was to determine the interrelationships of the high loading variables and the significant roots in the three independent analyses.

c) Data Preparation

The time of an event during an observation was recorded by noting the time to the nearest minute when the event began and when the event ended. Thus, events of short duration frequently have identical starting and ending times because the minute did not change during the occurrence of the event. For example, a given event might be recorded as beginning at 11:58 and as ending at 11:58. Other events were recorded as lasting exactly one minute although the actual duration was slightly less or slightly longer than one minute. A third situation occurs when events last longer than one minute and are recorded as lasting for two or more minutes. For example, a particular event might last two-and-a-half minutes and be recorded as lasting from 11:59 to 12:02. Thus time recorded during observations are accurate only to the nearest minute.

Many different sequences of the above time situations occurred in the data. Frequently a string of five or six events all have beginning and ending times which are the same. These may then be followed by an event with the same beginning time as the others, but with an ending time a minute later. A representative type of sequence is illustrated by the following:

Event	Beginning	Ending
1	9:45	9:46
2	9:46	9:46
3	9:46	9:46
4	9:46	9:47
5	9:47	9:47
6	9:47	9:48
7	9:48	9:48
8	9:48	9:48
9	9:48	9:51

The nine events shown all took place from 9:45 to 9:51, an apparent span of six minutes. Event 1 began during the minute labeled 9:45 and ended during the minute labeled 9:46. However, this does not necessarily mean that Event 1 lasted for exactly one minute. Events 2 and 3 both began and ended during the minute labeled 9:46. Routine subtraction of beginning time from ending time would indicate that neither Event 2 nor 3 took any time, which of course is not the case. On the other hand, there is no evidence to indicate that the two events each took one half of the minute beginning at 9:46. In fact, the two events together probably took up less than the entire minute because Event 1 ended during the minute labeled 9:46 and Event 4 began during the same minute. Similar situations occur for the other events listed above in the example.

In determining the cumulative time of various classes of events in the classroom, the manner in which the time was recorded created several problems. It would be entirely misleading to conclude that events which have the same starting and ending times took up no time at all. On the other hand, it would be equally misleading to allocate an entire minute for each event which occurs within a single minute. Thus, it was decided to divide up the time approximately equally among events occurring within the same recorded minute, and an automatic computer program was written to allocate times (see sample output in Table 4-3). The following rules were followed in the program:

1) When the beginning and ending times of an event are different and when the event does not follow other events with the same beginning time, the difference between the ending and beginning times is the time of the event. (Thus, one minute would be allocated to Event 1 in the above example.)

2) When a series of events have the same beginning and ending times (e.g., Events 2 and 3 above) and when the series is terminated by an event having an ending time one minute later than the beginning time (e.g., Event 4 above), one minute is divided equally among the events in the series including the terminating event. (Thus, one minute is divided equally among Events 2, 3, and 4 in the above example giving a time of .33 minutes for each.)

3) When a series of events have the same beginning and ending times (e.g., Events 7 and 8 above) and when the series is terminated by an event having an ending time of more than one minute later than the beginning time (e.g., Event 9 above), one minute is divided equally among the

events in the series _excluding_ the terminating event and the terminating event is assigned the difference between ending and beginning times minus the one minute assigned to the other events. (Thus, one minute is divided between Events 7 and 8 and in the above example giving a time of .50 for each. Then the difference between 9:51 and 9:48 minus the one minute--two minutes--is assigned to Event 9.)

These rules are arbitrary and could have taken slightly different forms. The times allocated to events by the application of the rules are not, of course, the actual times elapsed during the events, but they are more accurate than applying the single rule of subtracting beginning from ending times. It is difficult to estimate how inaccurate the times are, but for no single event is the time assigned more than one minute off. In most cases the times assigned are considerably less than a minute off from the true times. Consider again the example of event times given above. Assume that the true time of Event 2 is 59 seconds--that it began exactly as the minute labeled 9:46 began and that it ended at 9:46 allowing one second for Event 3 to be completed and for Event 4 to begin. The time assigned to Event 2 by Rule (2) above is .33 minutes (20 seconds) which differs from the true time by 39 seconds. Event 3 has true time of one second and an allocated time of .33 minutes (20 seconds) which represents a difference of 19 seconds, or an average error in assigned times for the two events of 29 seconds. The range of the error for a given event would be from 0 to 60 seconds and the range of the average error for a series of events assigned to one minute would be from 0 to 30 seconds with an expected error of 60/N where N is the number of events in the sequence. For a period of several minutes the sum of the allocated times equals the sum of the actual times.

After calculating times for each event according to the above procedures, the program calculated the sum of the times of the 45 selected events (those events being studied--see text above) and then calculated the percentage of time of the selected events consumed by each event during the observation. These percentages became the basis for the statistical analyses that follow.

A second computer program was used to find the average percent time across observations within teachers so that one measure for each variable per teacher could be used (instead of one for each observation). A third program was written to normalize the percentages within each variable using the method of unequal intervals.[3] The program punched out normalized standard scores for use as input to subsequent analysis programs.

4. Discriminant Function Analyses

a) The Six High School Departments and the Two Elementary Schools

The data (percent time selected) on the 45 categories were averaged across the observations for each teacher and then normalized as described above. The data were then divided into three clusters as shown in Table 4-5 for three separate discriminant function analyses so that in each run the ratio of subjects to variables would be at least two to one.

The first analysis consisted of the 18 categories dealing with the subject matter. This analysis produced three significant roots. The loadings of the 18 variables of these roots are shown in Table 4-6 and the centroids of the groups on the discriminant score vector are shown in Table 4-7. For root A1, the centroids of the two elementary schools and the Social Studies Department are grouped at the low end of the discriminant score vector and the centroids of the Science Department, followed closely by those of the Mathematics and English Departments are at the upper end of the vector. This root involves the amount of time spent in grading and cognitive logistics activity, which indicates that the elementary schools and the Social Studies Department spend less time in these activities than the Science, Mathematics, and English Departments.

The second significant root in the first analysis, A2, is the amount of time involved in giving information (1103-1104-1203-1703) and in interrogation (1712). Mathematics and Social Studies are the highest on the discriminant score vector for this root followed by Language. English, Science, Nova II, Nova I, and Technical Science are clustered, in that order, at the low end of the vector.

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[3]Edwin E. Ghiselli. Theory of Psychological Measurement. New York: McGraw-Hill, 1964. Pp. 84-88.

RUN[a]	#	EVENT[b] CATEGORY	SIGNIFICANT ROOTS[c] RUN A A1	A2	A3	RUN B B1	B2	RUN C C1	C2	ROOTS OBTAINED USING 18 HIGHEST LOADING EVENTS ONLY D1	D2	D3	D4	D5	D6	D7	UNIVARIATE TESTS F	P
A	1	1103 1104 1203 1703		.61				1					-.62				3.2	.01
	2	1701		-.41									.38				1.7	.15
	3	1709[d]		.36													1.4	.24
	4	1712		.44								.47					2.1	.07
	5	1713			.40								.62			.37	1.6	.18
	6	1714		.37	.50						-.58				.54		3.0	.02
	7	1715	-.42							-.42							1.8	.13
	8	1723	.60							.52		.37					4.0	.00
	9	1731	.50							.52							2.0	.10
B	10	2102				.49					-.46						1.8	.13
	11	2304[d]				-.36											2.5	.03
	12	2707					.54			-.51				-.41			3.8	.01
	13	2703				-.61					.54			-.51			4.7	.00
	14	2704 2705 2716 2203				.43											1.4	.23
	15	2711				-.51						.60					1.9	.10
C	16	2718[d]						.35									1.3	.29
	17	3703							.57								1.4	.25
	18	3712 3713							.65				.39				1.6	.18
	19	3723 3724 3727						.68				-.40		.38			2.7	.03
	20	3732 3733						.37				-.46			.40		3.4	.01
	21	7000							.74		.42		.46				3.5	.01

[a]Three initial runs were made with 18, 18, and 9 variables respectively.
[b]Only events having an absolute loading of .35 or greater are reported.
[c]Roots are included where χ^2 has a probability of $p \leq .05$.
[d]Events loading below an absolute value of .37 on Runs A, B, or C are not included in Run D.

DISCRIMINANT ANALYSIS OF THE SIX HIGH SCHOOL DEPARTMENTS AND THE TWO ELEMENTARY SCHOOLS

Table 4 - 6

	DISCRIMINANT ROOTS													
GROUPS	A1	A2	A3	B1	B2	C1	C2	D1	D2	D3	D4	D5	D6	D7
SCIENCE	0.87	-0.42	0.29	1.39	-0.38	0.08	-0.49	0.54	-0.97	-0.52	0.90	0.56	-0.44	-0.01
MATHEMATICS	0.59	1.24	0.74	0.33	-0.19	-0.27	0.02	0.80	-1.18	0.50	0.01	-0.61	0.60	-0.02
SOCIAL STUDIES	-0.53	1.19	0.04	-0.59	0.04	-0.28	0.56	-0.30	0.06	1.12	-0.79	0.92	0.78	-0.03
LANGUAGE	0.16	0.63	-1.60	-0.43	-0.13	-0.40	-0.78	0.11	0.54	0.69	-1.40	-0.44	-0.67	-0.01
TECH. SCIENCE	0.13	-0.10	-0.70	0.52	0.31	1.71	0.33	0.98	0.96	-1.34	-0.40	0.04	0.51	0.04
ENGLISH	0.50	-0.62	-0.01	-0.80	-0.78	-0.37	1.52	0.59	0.89	0.86	0.98	0.06	-0.07	0.02
NOVA I	-0.87	-0.19	0.15	-0.16	0.53	-0.11	-0.40	-0.88	0.08	-0.45	0.19	-0.13	0.15	-0.13
NOVA II	-0.68	-0.28	0.27	-0.02	1.11	-0.02	-0.37	-0.87	-0.27	-0.14	0.03	-0.06	0.13	0.30

CENTROIDS OF SIX HIGH SCHOOL DEPARTMENTS
AND THE TWO ELEMENTARY SCHOOLS
ON DISCRIMINANT ROOTS

Table 4 - 7

The third significant root involves the amount of time spent in evaluation (1713 and 1714). Language is extremely low on the discriminant score vector followed by Technical Science; Mathematics is highest and the other departments with the elementary schools are clustered near the middle.

The second analysis produced two significant roots and a third factor closely approached significance. The first of these roots, B1, involves time spent in inner systems management (2703) versus outer systems management (2704), with the outer systems management loading positive. Also, for some reason, use of instructional materials by the teacher (2102) loaded positively on this root. Science is at the high end of the discriminant score vector and is somewhat isolated from the other groups. English is at the lower end and moving upward from it are Social Studies, Language, Nova II, Nova I, Mathematics, and Technical Science.

The second root in this analysis, B2, has a single high loading which is punishment for systems performance (2702). Highest on the discriminant score vector for this root is Nova II, followed by Nova I, and Technical Science. At the lower end is English and grouped in the middle are the remaining departments.

The third analysis also produced two significant roots. The first of these roots is heavily involved with the percent of time of giving information about the outside world including guidance information (3723-3724-3727) and the percent of time involved with outside world evaluation (3732-3733). Technical Science is very high on the discriminant score vector for this root with all of the other groups clustering at the other end of the vector. Since outside world and guidance categories include career information, which is a major concern of the Technical Science Department, one would expect to find Technical Science high on the score vector for this root. Studying the univariate tests confirms that the high centroid position of Technical Science is due primarily to the guidance and career items.

The second root of the third analysis is made up of categories involving affective evaluation (3712-3713); affective information (3703); and no relevant observable teacher activity (7000). English is the high scorer on the discriminant score vector and Language is the low scorer followed by Science and the two elementary schools. The remaining departments are scattered in the middle. The loadings and the univariate comparisons indicate that much of English's high showing on this root is due to no observable relevant teacher activity. Events coded 7000 should not be considered to be ones in which the teacher was not performing his job adequately. Events which are typically coded 7000 include the teacher leaving the room, the teacher walking silently around the room, and the teacher sitting quietly while a student recites. Since assigning such activities to other categories would require extensive inferences by the observer, they are classified as no overt relevant teacher activity.

A total of 21 variables loaded with an absolute value of .35 or greater on the seven significant roots obtained in the three discriminant analyses. Since the three runs were made independently it is possible that the roots obtained in each analysis may overlap the roots obtained in the others. To determine the relationship between the variables in the different analyses, it was decided to do a fourth analysis encompassing only the variables which loaded high on significant roots in the previous three analyses. In order to maintain the ratio of two subjects to every variable only 18 variables out of the 21 were used. These included all variables with an absolute loading of .37 or greater which eliminated events 1709, 2304, and 2718.

The seven roots obtained are also shown in Table 4-6 and the group centroids are in Table 4-7. The first five of the roots contain three or more loadings of $\pm .35$ or larger--Roots D1, D3, and D4 each contain five large loadings while D2 contains four and D5 contains three. Thus, no single root emerges as representative of the majority of variables considered. Rather, most of the variables were scattered over five roots.

The significance attributed to each root by the discriminant function program is at best misleading, because the highest loading variables on the significant roots in the previous analyses were grouped for the fourth analysis. Any spurious significance associated with the previous analyses will be magnified in the fourth through combination with other spurious significance. Thus, in interpreting this particular analysis, significance will be ignored. The principle purpose of Analysis D is to determine the interrelationships among the various events. While significance is being generally ignored, there is no reason to believe that all of the roots are significant. Since it is expected that significance will be inflated, those roots with non-significant Chi Square values are probably not significant.

Root D1 loads positively with grading events (1723) and logistical information events (1731) and the cluster on questions and evaluations of the outside world (3732-3733 It loads negatively with teacher elaboration requests (1715) and punishers for systems performance (2702 These events do not seem to group logically and the common variance may be due to external causative factors. Technical Science and Mathematics centroids are high on the discriminant score vector for this root and the two elementary schools are low.

Root D2 loads positively with cognitive management events (2703) and no observable relevant teacher activity (7000) which do not have an obvious relationship. It loads negatively with general evaluation events (1714) and non-instructional materials (2102) which also do not have an apparent commonality. Technical Science and English centroids are high on the score vector and Mathematics and Science centroids are low.

Root D3 loads positively with subject matter questions (1712), grading (1723), and grouping students (2711). This root loads negatively with the event cluster for guidance and career activities (3723-3724-3727) and with questions and evaluation related to the outside world (3732-3733). Social Studies centroid is high on the score vector and the Technical Science centroid is low. This seems in part to reflect the concern of the Technical Science Department with career activities.

Root D4 has a high positive loading for subject matter rewards and evaluation (1701-1713), affective questions and evaluation (3712-3713), and no observable relevant activity (7000), and negative loadings for information giving events (1103-1104-1203-1703). Three of the positive loadings deal with evaluation and reward, and the fourth (7000) is the absence of overt relevant teacher activity. The negative loading is giving subject matter information. The English Department is highest on the discriminant score vector and the Language Department is lowest.

Root D5 has a single positive loading, 3723-3724-3727, and two negative loadings, 2702 and 2703. The positive loading concerns the evaluation of club and career activities and the negative ones concern punishment and inner system management. Social Studies is high on the score vector for this root and Mathematics is low.

Root D6 loads positively with events 1714 and 3732-3733, both of which deal with evaluations. Social Studies is high on the score vector for this root and language is low.

Root D7 loads positively only with event 1713 which is structured evaluation. Nova II is high on the discriminant score vector and Nova I is low.

b) LAP Classes, Traditional Classes, Non-LAP-Individualized Classes, and Mixed Classes

For the second comparison, the observations were arranged into the four groups discussed above of LAP, Traditional, Non-LAP-Individualized, and Mixed. The percent time data on the forty-five categories were averaged across the observations for each teacher within one of the four groups. In cases where a teacher was observed in more than one of the four situations only the observations in one situation were used, the others being omitted for this particular analysis. In general, the teacher was assigned to the group in which the majority of the observations fell, but in a few situations the classes for a teacher were equally distributed across the groups. In those cases an arbitrary decision was made to place the teacher in the group which had the lowest number of teachers. After averaging across observations within teachers, the data were normalized as previously described.

The first of the three discriminant analyses produced a single significant root, AA1. (See Table 4-8.) This root loads high with events involving the teacher getting or doing something for the student such as getting instructional materials for the students (e.g., 1303). Also, events dealing with the student evaluation load this root (1713 and 1714). The LAP classes are highest on the score vector for this particular root, followed in order by the Mixed classes, Non-LAP-Individualized classes, and at the far end, the Traditional classes, as shown in Table 4-9. This would indicate that teachers in LAP situations spend significantly more time in tasks such as getting material for students and in evaluating students than do teachers in the Traditional class situations. This difference is probably due to the structure imposed by the LAP.

The second analyses for these four groups produced two significant roots. The first of these roots loads positively with events such as teacher uses non-instructional materials (2102), teacher cleans facilities (2201), teacher constrained by systems logistical breakdown (2305),

		EVENT[b]	RUN AA	RUN BB		ROOTS OBTAINED USING 14 PRE-VIOUSLY HIGH LOADING EVENTS ONLY:			UNIVARIATE TESTS	
RUN[a]	#	CATEGORY	AA1	BB1	BB2	DD1	DD2	DD3	F	D
AA	1	1102	.38			.38			1.5	.24
	2	1303	.49			.39	.46		3.4	.03
	3	1704	.40			.37			1.5	.22
	4	1713	.36			.37			1.9	.15
	5	1714	.51			.48		.66	5.3	.00
	6	1723	.37			.38			1.6	.21
	7	1731	.44			.42			2.2	.11
BB	8	2102		.43		.39			2.0	.14
	9	2201		.35					1.6	.21
	10	2305		.58		.54			4.3	.01
	11	2703		-.72	-.44	-.81			15.7	.00
	12	2704 2705 2716 2203		.49		.50			2.9	.05
	13	2710		.49		.45			2.7	.06
	14	2712 2713			.50	.46	.45		4.2	.01

[a]Three initial runs were made with 18, 18, and 9 variables respectively. Run CC had no significant roots.

[b]Only events having an absolute loading of .35 or greater are reported.

[c]Roots are included where χ^2 a probability of $p \leq .05$.

DISCRIMINANT ANALYSIS OF FOUR TEACHING SITUATIONS

Table 4 - 8

TEACHING SITUATIONS	DISCRIMINANT ROOTS					
	AA-1	BB-1	BB-2	DD-1	DD-2	DD-3
LAP	0.72	1.00	-0.06	1.31	-0.31	-0.09
TRADITIONAL	-0.81	-0.56	-0.66	-1.14	-0.47	-0.15
NON-LAP-INDIVIDUALIZED	0.90	-0.35	0.39	-1.13	0.32	0.60
MIXED	0.27	-0.41	0.79	-0.03	0.65	-0.58

CENTROIDS OF THE FOUR TEACHING SITUATIONS ON THE

DISCRIMINANT ROOTS

Table 4 - 9

outer systems management (2704-2705-2716-2203), and traffic control (2710). It has a single, high, negative loading which is cognitive management (2703). It is not clear what this root best represents. The highest group on the discriminant score vector for this root is the LAP group; the other three groups all cluster at the lower end of the vector.

The second root extracted in this analysis, BB2, loads systems evaluation (2712-2713) and cognitive management (2703) in opposite directions. The high group on this root is the Mixed situation and the low group is the Traditional situation. The LAP and the Non-LAP-Individualized situations lie between these fairly equally distributed.

The third analysis dealing with the last nine variables failed to produce a single significant root. The univariate tests also were totally nonsignificant.

When the fourteen variables with the highest loading (±.35 or greater) on the significant roots in the first three discriminant analyses were selected and analyzed together in a further analysis, one strong root, DD1, emerged as indicated in Table 4-8. All but one of the variables loaded at .35 or higher on this root. The variable which did not load was 2201 (cleaning facilities) which had previously loaded at .35 on root BB2. Its loading on DD1 is .31, which is higher than its loading on the other two roots in the fourth analysis. The LAP group was highest on DD2 with a centroid of 1.31, while the Traditional group was lowest with a centroid of -1.14. The Non-LAP-Individualized group was next lowest (-.12) and the Mixed group was next (-.02), but these two groups essentially cluster together. This root separates the LAP and Traditional centroids more than any of the previously obtained roots. Thus, it appears that root DD2 discriminates well between the Traditional and the LAP situations and separates both from the other two situations. It should be emphasized that the significance level associated with root DD2 should be ignored since the variables comprising this fourth analysis were all taken from highly significant roots on the previous runs. Thus, while it is safe to assume significance for root DD1 because of its composition, the actual level of significance is not known since almost all of the spurious significance associated with the variables has been combined in it.

The information provided by this root (DD1) illustrates important differences between the LAP and the Traditional situations. The highest loading (and the only negative one) on the root is cognitive management (2703) which is comprised of the noncognitive directions, statements, requests, and inquiries a teacher uses to manage cognition in the classroom. This implies that teachers in the Traditional situations devote considerably more time to classroom management of cognition than do teachers in the LAP situations. (This is probably because in LAP classes many of these management functions are performed by the LAP.) The other variables, all of which load positively, can be divided into three general groups.

The first of the groups is comprised of events 1102, 1303, 1704, 2731, and 2305 which deal with various aspects of logistical support for cognition and systems management. Apparently, LAP teachers spend more time in such activities than do Traditional teachers.

The second group of events consists of 1713, 1714, 1723, 2712, and 2713--these events involving grading (grading is further discussed in a later section) and evaluation in both subject matter performance and in systems management. The third group of events includes the 2704-2705-2716-2203 cluster and 2710, which deal with imparting information about the educational system with the use of equipment and traffic control. (A later section discusses traffic control at greater length.) Both of these groups find the LAP teacher engaging in the activities more often than does the Traditional teacher.

The final event, which does not seem to logically group with any of the others, is the use of noninstructional materials which aid in the management of students (2102). This particular event also loaded high in the comparison among the departments and elementary schools with the highest centroid on that comparison being in Science.

Six additional events also loaded high in the department comparisons as well as the situation comparison--these are 1713, 1714, 1723, 1731, 2703, and the 2704-2705-2716-2203 cluster. Since these events did load high in both comparisons, it is difficult to determine if they loaded because of the department, because of the teaching situation, or because of both factors. The remaining events, which loaded uniquely in each analysis, can generally be considered to vary as a function of the factors in the analysis in which they loaded.

7) The Intercorrelation of RO_1 and MACI Variables

In an attempt to determine interrelationships of events within the classroom, 20 RO_1 variables were isolated and intercorrelated with 20 MACI variables, using observations made on the same 28 teachers. One to five observations were available for each teacher, and where multiple observations existed for a teacher, averages across observations were used. The variables were selected, in part, on the subjective criterion of being generalizable to situations outside the specific Nova environment. No attempt was made to employ specific empirical criteria for selection such as frequency of occurrence. As in the other analyses, percent time (selected) was used as the measure of the events on the RO_1. The MACI measures used were the seventeen proportions and three typical times described in Table 2-4. The variables were not normalized for either instrument prior to obtaining the correlations. The intercorrelations are presented in Tables 4-10, 4-11, and 4-12 (three tables are used to facilitate presentation and discussion).

Since percent time is the RO_1 measure, care must be taken in interpreting negative correlations with RO_1 events. As the percent time of one event increases for a given observation (or teacher) the percent of time left for other events to occur is decreased. Consequently, negative correlations can conceivably occur when increases in one activity prevent the occurrences of other activities because of a lack of time. For example, there is a negative correlation (-.44) between traffic control (2710) and positive reinforcement for progress (1721). This correlation might mean that when the teacher is frequently involved in traffic control activities, she does not have time to reinforce students for progress. (Of course, there are other interpretations.) Because the MACI variables are primarily proportions of frequencies, the availability of time to perform activities is not a major factor.

There are three logically distinct groups of correlations with which to be concerned in this analysis--they are the intercorrelations of the RO_1 variables alone, the intercorrelation of the MACI variables alone, and the cross-correlations of the RO_1 and MACI variables. For ease of reading, only the significant correlations (for $n=28$ and $p \leq .05$, $r \geq .35$) are reported in the tables. Of those reported, only those which seem to have interpretations meaningful to the study are discussed.

It is important to state here that a factor analysis was not feasible because the number of variables exceeds the number of subjects. An interpretable factor analysis should have as a minimal criterion more subjects than variables, and the ratio should perhaps be 10 to 1 or greater.

	1 1103 1104 1203 1703	2 1303	3 1704	4 1707	5 1709	6 1712	7 1713	8 1714	9 1715	10 1721	11 1723	12 1731	13 2703	14 2706	15 2707	16 2709	17 2710	18 2712 2713	19 2718	20 7000
1. 1103,1104 1203,1703		-.54		-.38		.44	-.51								-.46			-.41	-.37	-.38
2. 1303						.42		.38							.38				.48	.36
3. 1704																				
4. 1707																				
5. 1709										.48										
6. 1712										.53					-.45			-.45	-.49	-.62
7. 1713										-.36					.56					
8. 1714													-.45							
9. 1715										.44										
10. 1721																	-.44	-.40		-.45
11. 1723											-.40									
12. 1731													-.65				.63			
13. 2703																	-.51	-.41		
14. 2706																		.44		.36
15. 2707																.52				
16. 2709																				
17. 2710																				
18. 2712,2713																			.42	.56
19. 2718																				.38
20. 7000																				

THE INTERCORRELATION OF TWENTY RO_1 VARIABLES

Table 4-10

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
	1/1+2	1-1T/ (1-1T)+ (2-2T)	M2+ MT/SB	2T/2	2T/SB	RCF1	RCF2	O+aa /TB	bb/TB	1 /SB	RCF 1	3/SB +3	SB/SB +TB	X/SB	(1-X)+ (2-X)+ (/-X)+ (1 -X) /SB	K/SB	L/TB	d+e /d+ e+L	dc/ TB	C/TB
21				-.53	-.58	.74			.43					.86	75	-.48				
22																				
23																				
24					.91	-.43							.35	-.44			.37	-.36		
25						-.42								-.44			.39	-.43		
26														.71	.87					
27													.48							
28												.41								
29												.39		.53					-.35	
30																				
31																				
32																				
33																-.53	.58	-.41		
34															.76	[illegible]			-.36	
35																[illegible]				
36																	-.73	.59		
37																		-.88		
38																				
39																				
40																				

Description:

21.1/1+2
22.1-1T/(1-1T)+(2-2T)
23.M2+MT/SB
24.2T/2
25.2T/SB

26. RCF1
27. RCF2
28. O+aa/TB
29. bb/TB
30 1 /SB

31. RCF 1
32. 3/SB+3
33. SB/SB+TB
34. X/SB
35. (1-X)+(2-X)+(/-X)+(1 -X)/SB

36. K/SB
37. L/TB
38. d+e/d+e+L
39. dc/TB
40. C/TB

THE INTERCORRELATION OF TWENTY MACI VARIABLES

Table 4 - 11

		21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
		1/1+2	1-1T/ (1-1T)+ (2-2T)	M2+ MT/SB	2T/2	2T/SB	RCF1	RCF2	0+aa /TB	bb/TB	① /SB	RCF ①	3/SB+ +3	SB/SB +TB	X/SB	(1-X)+ (2-X)+ (1-X)+ (①-X) /SB	K/SB	L/TB	d+e /d+ 2+L	dc/ TB	C/TB
1	1103																				
	1104																				
	1203																				
	1703																				
2	1303	.47													.50	.40	-.39	.36	-.45		
3	1704																			.54	
4	1707												.38								
5	1709							-.38													.55
6	1712																				.35
7	1713		-.35	.39	-.35																
8	1714		.44							.52					-.49				-.38		
9	1715																				
10	1721																				.58
11	1723				-.52	-.50															
12	1731									.49			.57								
13	2703		-.37							-.48											
14	2706							.42						.35							
15	2707													-.55							
16	2709													-.35							
17	2710									.44			.48								
18	2712	.43		.37																	
	2713																				
19	2718																				
20	7000																				-.37

CROSS - CORRELATION OF TWENTY RO_1 VARIABLES WITH TWENTY MACI VARIABLES

Table 4 - 12

Intercorrelations of RO_1 Events

It can be seen in Table 4-10 that the cluster of events dealing with the teacher giving subject matter information (1103-1104-1203-1703) correlates negatively with seven other categories. These negative correlations may imply that sufficient time was not available for the occurrence of the other events because of the time consumed by information giving. However, the events include ones which might tend to be incompatible with extensive information giving; for example, getting materials for students (1303) and giving systems directions to students (2707) probably conflict with extensive subject matter presentation. Information giving correlates positively with asking subject matter questions (1712) which suggests that teachers imparting information also ask questions about it.

Several interesting correlations occur with event 1303 (teacher gets materials for students). In addition to correlating with the information cluster above, it correlates negatively with 1712 (subject matter questions) which implies that teachers who get materials for students do not tend to ask subject matter questions, either because of the time limitation or because of the nature of the class or teacher. Event 1303 correlates positively with events 2707 (system directions to student), 2718 (directing students to do logistical tasks), 1714 (general evaluation), and 7000 (no observable relevant teacher behavior). These events do not intercorrelate significantly with each other, except for 2718 with 7000, and as noted above, 1712 with the information cluster. These findings seem to indicate that the various other events relate directly to the teacher getting materials for students and not because of any complex relationships with other variables. In the discriminant analysis, it was found that the high occurrence of 1303's was associated with LAP situations but not with Traditional ones. Therefore, the events which correlate with 1303 are also associated with LAP situations. The correlations with 1303 will be discussed at greater length in a later section.

Event 1709, negative feedback on subject matter, correlates positively with event 1721, positive reinforcement for progress. This relationship suggests that teachers in Nova who give negative feedback to students, also reinforce them for progress. Positive reinforcement also relates positively to asking subject matter questions (1712) and to elaboration requests (1715). It relates negatively to structured evaluation events (1713), to traffic control (2710), to asking educational system questions (2712), and to no observable relevant activity (7000).

3

Again, the limitations imposed by the time factor must be considered in interpreting these negative correlations. The other significant correlations among the RO_1 events will not be discussed.

Intercorrelation of MACI Variables

Table 4-11 presents the intercorrelations among the MACI variables. In general these tend to be higher than among the RO_1 events. Some of these high correlations may be due to confounding in the formation of the ratio's which are used as the MACI variable measures. For example, the high correlation (.91) between 2T/2 and 2T/SB may be due in part to such confounding. (For explanation of these symbols, refer to Chapter II, Table 2-4.) Item 2T/2 is the proportion of all low level student contributions that are total class performances and item 2T/SB is the proportion of all student behavior accounted for by total class performances of low-level contributions. These items are not independent; rather, item 2T/SB is a direct function of item 2T/2. Thus, some of the variance held in common by these variables is due to the way in which they were calculated.

An interesting correlation among the MACI measures is the positive correlation between 1/1+2 and bb/TB. This suggests a positive relationship between the amount of students' original contributions and the amount of punitive teacher behavior. bb/TB also correlates positively with the proportion of spontaneous student contributions (X/SB). Both of these relationships appear superficially contradictory to the concept that punishment decreases the frequency of behavior. However, there is no evidence that the punitive behavior was directed at events 1/1+2 or X/SB. Further, the punitiveness of the behavior is inferred by the observers; there is no evidence that it was in fact punitive to the students. Item bb/TB correlates only .39 with item 3/SB+3 which is the proportion of student misbehavior. While significant, this low correlation suggests that only about 15% of the teacher's punitive behavior is in relation to student misbehavior. Another revealing correlation is that student misbehavior correlates .41 with the proportion of teacher behavior accounted for by empathy and praise (O+aa/TB). This means that 16% of the student misbehavior was accompanied (within the observation) by teacher "approval." Thus, the apparent relationship between punitive behavior and student contribution is at best ambiguous.

While direct relationships between events can be inferred from the intercorrelations among variables such as student misbehavior, teacher praise, and teacher punitive behavior as discussed above, extreme caution must be exercised in making such inferences. The data was averaged when several observations were made for the same teacher. Such averaging assumes that there is little or no variability in a teacher's activities in different situations, even though there is no empirical basis for that assumption. Conceivably, events could correlate significantly even though their occurrence was in different classes. Even within the same observation, events could correlate which are not directly related. For example, some students could misbehave during the first part of an observation and the teacher could praise other students during the last part of the observation. If such an occurrence was frequent, a significant correlation could occur between misbehavior and teacher praise. It is not the purpose of the intercorrelations reported here to infer which events effect or are effected by other events. Rather, the purpose is to ascertain which events tend to vary together across various teachers and teaching situations. High correlations only imply that events tend to occur (or not occur) together with some constancy throughout the sample.

Several of the remaining significant intercorrelations among the MACI items illustrate the interrelationships among lecturing, student contributions, teacher questions, and similar activities. Some of these will be discussed below as they relate to the cross-correlation of RO_1 to MACI.

RO_1 and MACI <u>Cross-correlations</u>

The cross-correlations between the RO_1 and the MACI in Table 4-12 provide some interesting findings. The event 1303, teacher gets materials for student, has several intercorrelations with MACI variables just as it did with some of the other RO_1 variables. It correlates positively with 1/1+2 (students' original contributions), with X/SB (spontaneous contributions), with (1-X)+(2-X)+(Z-X)+(1-X)/SB (student to student interaction), and with L/TB (relative amount of lecture). It correlates negatively with K/SB (students contribution where the teacher has selected a respondent) and with d+e/d+e+L (the number of questions the teacher asks). Careful study of the correlations will further reveal that the three items on MACI dealing with student contributions are highly interrelated and all correlate to student interactions. It appears that a considerable proportion of the contributions of students are of the student-to-student variety rather than being total class performances or student-to-teacher interactions.

Also, MACI variables K/SB, L/TB, and d+e/d+e+L (see above paragraph) are highly intercorrelated in a way which suggests that the more a teacher lectures, the less likely she is to select student respondents or to ask questions. Collectively, these various interrelationships say that in classes in which teachers frequently get materials for students (from the discriminant analysis, these classes tend to be LAP classes):

1) they tend to "lecture" in that class;

2) they tend not to select student respondents or ask questions (see also correlation of 1303 with 1712 above);

3) students tend to make original contributions and spontaneous contributions; and

4) the students tend to interact among themselves (many of the contributions in #3 may be to other students).

Previously, in the discussion of the intercorrelation of RO_1 events, it was found that teachers who get materials for students, also tend to:

1) not present subject matter information to the students;

2) give system directions to students;

3) direct students to do logistical tasks;

4) have general evaluations; and

5) exhibit no observable, relevant activity.

Not presenting subject matter, but lecturing tends to imply a contradiction in the data until the situation is examined more closely. The MACI lecture category includes all forms of information giving while the RO_1 category on information giving includes only subject matter information. Thus, the information giving implied by MACI must be of a non-subject matter nature. However, none of the other RO_1 information-giving categories correlate significantly with MACI's lecturing. It appears, then, that lecturing includes many information imparting activities and does not correspond directly to any single RO_1 category. (It should also be remembered that not all categories on either instrument were included in the intercorrelation.) Viewed in this light, lecturing tends to be less contradictory to the idea of the teacher getting materials for the students and to the frequent student-to-student interactions.

MACI item C/TB, which is the teacher's expansion of students' contributions, is positively correlated with RO_1 variables 1709 (negative feedback), 1712 (asking subject matter questions), and with 1721 (positive reinforcement for progress). One plausible explanation for these relationships is that MACI codes as contribution expansion, events which the RO_1 codes in the other categories. However, it is very likely that teachers who expand on contributions <u>also</u> give negative feedback, ask subject matter questions, and give positive reinforcement for progress.

MACI category 3/SB+3, which is the relative amount of student misbehavior, is correlated positively with RO_1 events 1707 (subject matter instruction), 1731 (cognitive logistics information), and 2710 (traffic control). Since 3/SB+3 includes restlessness as well as more violent forms of misbehavior, it seems likely that these correlations are because the students tend to be restless during events coded 1707, 1731, and 2710. It is not likely that such events occur more frequently during times that students are misbehaving and it is not likely that such student misbehavior is very extreme.

A contributory factor to the correlations with misbehavior may be that MACI is not specially designed for individualized teaching situations. Behavior which is regarded as discruptive in more conventional classrooms is innocuous in many individualized classrooms. Students regularly move about, talk to each other, procure materials, and perform similar activities in the individualized classes at Nova. Yet in many group taught classes, such behaviors would be taboo. The MACI instrument, however, does not differentiate between these polar situations.

Several other significant cross-correlations occur, but these will not be discussed here. In summary, the intercorrelations of the MACI data with the RO_1 data have revealed several interesting relationships. Perhaps the most involved of these is the relationship of many different events to RO_1 event 1303, teacher gets material for students. Several cautions should be followed in interpreting the various intercorrelations. Negative correlations, especially those involving RO_1 events, may occur because the occurrence of a particular event does not allow time for certain other events to occur. Some of the high correlations between MACI variables <u>may</u> be caused by a dependency between those variables derived from the method of ratio calculations. A final caution is to remember that all of the variables of both instruments were not included in the intercorrelation analysis.

6) Verbal Interaction
Scale (VIS) Analysis

The data collected with the modified Flanders verbal interaction analysis scale provided an information base which can be related to other teaching situations because of the widespread use of the Flanders technique. The data provided by this instrument present a good overall picture of classroom verbal interactions. Since the sample used for collecting these data differs from the sample used for the other data which were collected, they cannot be directly related to the other data. Since the sample is different and because the VIS is stylistic, this data complements the RO_1 data. This discussion of the VIS data is limited to overviews of the interaction patterns of the six high school departments and the two elementary schools.

Table 4-13 presents the VIS data for the high school departments, for the elementary schools, and for the Nova Complex. Since the classrooms were not identified as to teaching method at the time of the observation, no comparisons can be made among the LAP, Traditional, Individualized, and Mixed classes as were made for other data. Perhaps the most striking thing about the data in Table 3 is the general uniformity across the departments and schools. While no statistical tests have been applied to the data to determine if differences are significant, there appear to be only a few categories which experience notable fluctuation in percentage of occurrences. The two elementary schools are within two percentage points of each other in all categories except 7, criticizing or justifying authority, for which Nova I is 4.2 percentage points above Nova II. The comparison of the high school total to the elementary total also reveals considerable similarity. On seven of the eleven categories, the schools are within three percentage points of each other, and the largest difference in any category is 6.5 percentage points.

Within the high school, departmental variations are especially evident for categories 9, 10, and 11. For category 9, student-talk-initiation, Social Studies has the high of 24.9% followed closely by Science with 21.7%. Language is lowest with 7.2% and English is second lowest with 9.9%. For category 10, student-talk-response, the situation is the reverse; Language and English are highest with 20.5% and 16.3% respectively, while Social Studies and Science are lowest with 5.5% and 6.3%.

It should be noted that these reversals are not a function of the calculation of the percentages. The percentages are based on the total of all interactions and not the total of the two student-talk categories, so categories 9 and 10 are not related, because of the calculations, to any greater extent than are any other categories. It appears then, that when students talk in Science and Social Studies, they are the initiators, but that when they talk in Language and English, they are responding to the teacher.

Category 11, silence or confusion, has the highest percentage of occurrence in Technical Science (25.2%) followed by English (17.5%). The lowest departments are Mathematics (9.2%), Language (10.7%), and Social Studies (10.4%). Since activities recorded in category 11 can be either related to instruction or not related to instruction, an interpretation is difficult. For example, if students were working on their own and the teacher was not talking, it would be recorded as "Silence or Confusion." If the teacher was reading a comic book and the students were blowing bubble gum, it would also be recorded as 11.

Category 7, criticizing or justifying authority, is generally low in occurrence for the high school. English is highest (5.6%) and is closer to Nova II (6.0%) than to the other high school departments, which range from 1.5% to 3.1%. Category 7 is basically disciplinary in nature and it is reasonable to expect the elementary schools to have a higher incident of category 7 occurrences than the high school. Explanation of the English Department's relatively high showing on this category can only be speculated. It is of interest to note that English is also highest on category 2 (praises and encourages) and is second highest on category 1 (accepts feeling). These are reinforcement categories and the implication of English being high in these categories, as well as in category 7, is that English employs more verbal attempts at shaping student behavior than do the other departments. As was noted above, English also has a high incidence of student-talk-response which may explain the need for more verbal behavior shaping than the other departments.

The distribution of interactions across the eleven categories provides some indication of the general nature of the schools. As was noted above, there is a high amount of consistency across the departments and schools. When the high school totals and the elementary totals are ranked in order of magnitude, the Spearman Rank Order correlation coefficient (Rho) is .93--indicating extremely high agreement. Consequently, only a little information is lost if the distribution of interactions across categories is discussed for the entire complex, instead of for the different schools.

The grand total column in Table 4-13 shows that about one fourth (26.4%) of the interactions are accounted for by the teacher talking about facts, procedures, opinions, etc. (category 5). Approximately another one fourth (23.1%) is accounted for by student talk (categories 9 and 10). About one eighth (11.2%) of the interactions involve the teacher asking students questions (category 4) and slightly more than one eighth (14.4%) involve silence and confusion (category 11).

Of the approximate fourth remaining, about half (12.3%) involve reinforcing activities (categories 1, 2, and 3) and about half (12.5%) involve directing, commanding, ordering, criticizing, ignoring, and similar activities (categories 6, 7, and 8). (Category 6, giving directions, is not considered to be disciplinarian, while categories 7 and 8 are considered to be disciplinarian.)

Categories 4 and 5 added together constitute the instructional interactions, while the other teacher categories are non-instructional. Thus, instructional interactions occur 37.6 percent of the time which indicates that Nova teachers are involved to a considerable extent in verbal didactic instructional activities. The ratio of reinforcement activities (1, 2, and 3) to disciplinary activities (7 and 8) is slightly better than 2 to 1. This shows a strong tendency to approach behavior shaping positively rather than negatively.

Another way in which VIS data can be examined is by determining the percent of instances in which one category follows another.[4] Table 4-14 shows the proportion of instances in which the various categories followed student-talk-initiation (category 9) and Table 4-15 shows the proportion of instances in which the categories followed student-talk-response (category 10). These tables present the information broken down by department and by school. Studying the proportion of categories following the student-talk categories gives an indication of how student verbalizations are regarded.

In Table 4-14, the most frequent category to follow student-talk-initiation for both the high school and the elementary school is category 5, lecturing or giving

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[4]Ned A. Flanders. Unpublished book manuscript received through personal communication.

VIS CATEGORY	HIGH SCHOOL							ELEMENTARY			
	ENG.	MATH.	TECH. SCI.	SCI.	LANG.	SOC. STUD.	TOTAL H. S.	NOVA I	NOVA II	TOTAL ELEM.	GRAND TOTAL
1. ACCEPTS FEELING	2.1	1.9	1.5	2.9	.8	2.0	1.8	1.9	1.4	1.6	1.7
2. PRAISES OR ENCOURAGES	8.2	6.2	5.2	4.9	6.5	2.5	5.7	9.2	7.5	8.3	6.8
3. ACCEPTS OR USES IDEAS OF STUDENTS	3.1	3.3	2.3	8.9	5.3	3.0	4.4	2.2	3.6	2.9	3.8
4. ASKS QUESTIONS	13.5	13.3	8.9	8.6	11.8	7.8	10.8	11.4	12.3	11.9	11.2
5. LECTURING	19.6	33.3	27.3	26.7	30.2	40.3	29.1	22.9	24.8	22.6	[illegible]
6. GIVING DIRECTIONS	4.4	4.7	6.7	2.6	[illegible]	2.0	4.5	11.9	9.9	[illegible]	[illegible]
7. CRITICIZING OR JUSTIFYING AUTHORITY	5.6	3.1	1.9	3.0	1.7	1.5	2.7	10.2	6.0	8.1	4.9
8. IGNORES OR CUTS OFF STUDENT	.5	1.0	.3	.4	.2	.1	.3	1.0	.6	[illegible]	.5
9. STUDENT-TALK-INITIATION	9.2	12.7	13.5	[illegible]	7.2	24.9	13.9	7.5	9.6	8.6	11.7
10. STUDENT TALK RESPONSE	[illegible]	12.1	6.8	6.3	20.5	5.5	[illegible]	10.8	11.2	11.0	11.4
11. SILENCE OR CONFUSION	[illegible]	9.2	25.2	14.1	[illegible]	10.4	15.0	13.8	13.1	13.4	14.4

VIS PERCENTAGES BY DEPARTMENTS AND SCHOOL

Table 4 - 13

information. Most of these instances probably involve the student asking questions and the teacher replying. The next most frequent occurrence for both the high school and the elementary school is category 9 or more student initiated talk. This would imply that either the student continued to talk or that another student initiated talk.

Categories 1, 2, and 3, it will be recalled, constitute reinforcement activities. Summing across these three categories, it can be seen that for the high school, 20% of the events following student initiated talk are reinforcing while for the two ele-entary schools, 34% of the events are reinforcing. This difference between the schools is, of course, not surprising. The two elementary schools are very similar in amount of reinforcement, 35% for Nova I and 30% for Nova II and, except for Social Sciences, so are the departments in the high school. The other departments range from 21% to 26%, but Social Studies is only 12% indicating considerably less verbal reinforcement of student responses than the others.

All of the departments are relatively low in punishing events (categories 7 and 8) following student initiated talk. The range is from a low of 1% for Social Studies to a high of 9% for English. Thus, while Social Studies has a low proportion of teacher reinforcement, it also has a low frequency of punishment. Examination of the other proportions for Social Studies reveals that student initiated talk follows student initiated talk almost half the time (47%). In the discussion of the VIS percentages of occurrences presented in Table 4-13, it was pointed out that Social Studies had more student initiated talk than any other department. These data suggest that there is considerable student-to-student interaction taking place in Social Studies--perhaps in small group discussion.

Within the high school, the range of category 5 (lecturing) following student talk is from 22% for English to 41% for Language. Reference to Table 4-13 will show that Language has the lowest percent of student initiated talk (7.2%) and now Table 4-14 implies that much of that talk is to ask questions, which are subsequently answered.

Table 4-15 gives the proportion of times each category follows category 10, student-talk-response. In the high school, lecturing occurs most frequently (22%) followed by more student-talk-response (18%) and teacher asking questions (16%). In the elementary schools, praise follows most often (22%), followed by more student-talk-response (20%) and teacher questions (17%). Thus, an important difference exists between the elementary schools where students are praised for their responses and the

INSTRUCTIONAL DIVISIONS	VIS CATEGORIES										
	1	2	3	4	5	6	7	8	9	10	11
SCIENCE	.07	.04	.08	.10	.25	.02	.03	.01	.33	.00	.03
TECHNICAL SCIENCE	.05	.10	.10	.11	.34	.07	.00	.02	.13	.00	.08
LANGUAGES	.08	.06	.12	.06	.41	.02	.02	.02	.15	.01	.04
SOCIAL STUDIES	.03	.03	.06	.08	.24	.01	.01	.00	.47	.00	.06
ENGLISH	.06	.09	.06	.10	.22	.01	.06	.03	.32	.00	.03
MATHEMATICS	.06	.07	.10	.11	.34	.01	.03	.01	.21	.00	.05
HIGH SCHOOL TOTAL:	.06	.08	.08	.10	.29	.03	.02	.01	.28	.00	.05
NOVA I	.06	.19	.05	.10	.30	.04	.03	.03	.15	.01	.04
NOVA II	.13	.13	.09	.06	.23	.12	.05	.05	.09	.01	.02
ELEMENTARY SCHOOL TOTAL	.09	.17	.07	.08	.27	.07	.04	.04	.12	.01	.03

PROPORTIONS OF INSTANCES IN WHICH THE VARIOUS VIS CATEGORIES IMMEDIATELY FOLLOW STUDENT - TALK - INITIATION

Table 4 - 14

INSTRUCTIONAL DIVISIONS	VIS CATEGORIES										
	1	2	3	4	5	6	7	8	9	10	11
SCIENCE	.03	.08	.11	.14	.22	.05	.04	.00	.10	.10	.14
TECHNICAL SCIENCE	.04	.10	.06	.18	.19	.07	.04	.00	.07	.15	.11
LANGUAGES	.02	.13	.15	.13	.26	.03	.02	.00	.02	.23	.14
SOCIAL STUDIES	.04	.02	.04	.16	.27	.02	.00	.00	.14	.14	.18
ENGLISH	.03	.21	.07	.20	.11	.04	.04	.01	.02	.16	.12
MATHEMATICS	.05	.27	.07	.20	.19	.06	.01	.00	.02	.10	.02
HIGH SCHOOL TOTAL	.03	.13	.11	.16	.22	.04	.03	.00	.04	.18	.07
NOVA I	.02	.19	.02	.18	.14	.04	.05	.01	.04	.27	.03
NOVA II	.02	.24	.11	.17	.11	.07	.03	.02	.05	.12	.05
ELEMENTARY SCHOOL TOTAL	.02	.22	.06	.17	.13	.06	.04	.01	.05	.20	.04

PROPORTIONS OF INSTANCES IN WHICH THE VARIOUS VIS CATEGORIES IMMEDIATELY FOLLOW STUDENT - TALK - RESPONSE.

Table 4 - 15

high school, where the teacher talks some more after the responses. The implications could be either that high school teachers do not think that it is necessary to praise student's responses or else they praise them on a more intermittent schedule than do elementary teachers (total reinforcement, categories 1, 2, and 3 is about the same for the high school as for the elementary schools).

Examining the proportions within the high school departments, it can be seen that praise (category 2) ranges from a low 2% for Social Studies to a high of 27% for Mathematics--a figure higher than either elementary school. Total reinforcement ranges from 10% to 39% for the same departments. The departments were ranked on a percent of reinforcement and a percent of responding and a Specimen Rank Order correlation coefficient was calculated. This coefficient is .72 which indicates a strong relationship between the number of responses and the proportion of times reinforcement follows the responses. When the proportion of punishment following category 7 is ranked and correlated with the ranked proportion of student responses, the coefficient obtained is .24. This is a small relationship which is, surprisingly enough, positive instead of negative as might be expected. Since the activities being punished are solicited responses, it is, of course, difficult for the student to stop responding even with punishment.

5) Empirical Grouping of Teachers

(1) Reasons for Grouping

In the preceding sections, attention has been given to the identification of differences among *a priori* groupings of teachers. One set of groups, the various high school departments and the elementary schools, was studied to determine what differences exist among teacher behaviors because of the organizational and curricular divisions. The second set of groups studied consisted of four divisions made on the basis of teaching method. These methods were LAPs, Traditional, Non-LAP-Individualized, and Mixed. The observational data for these logical groups were examined to ascertain what behavioral patterns tended to be unique to each group because of teaching method.

Another approach to examining the relationships between the observational data and situational, environmental, and personal variables associated with the teacher and her classroom is to empirically group the data and then ascertain the salient characteristics of each of the formed groups. A primary concern in the study is the determination of the unique role behaviors associated with the innovative, individualized aspects of the Nova Schools. While the relationship of behavioral patterns of teachers to the teachers' own demographic and personality characteristics certainly has value to a descriptive study of this nature, such relationships are not the primary concern. Yet, it is to be expected that teacher similarities in personality, background, intelligence, etc. will relate to the intra-group similarities in behavioral characteristics in empirically derived groups. However, if instructional and situational variables do account for aspects of similar patterns of teacher behavior, they should also be identifiable in the empirical groupings.

Numerous group clustering procedures have been developed and are reported in the literature. Three different components of pattern or profile similarity have been identified and are employed in grouping procedures--these are elevation, shape, and scatter.[5] Different grouping procedures employ one or more of these components to various degrees, with few procedures employing all three completely. The potential user of grouping procedures is forced to make a choice among the various methods, keeping in mind that the three components of similarity are utilized differently in different methods. In general, the user is forced to make a choice among methods with only limited information about the usefulness of each method for the particular application. For the behavioral data in this study, two grouping procedures have been utilized for different purposes. The characteristics of these particular methods, the rationale for selecting them, and the way in which they were employed are discussed in the following two sections.

(2) Inverse (Q) Factor Analysis

The first grouping procedure employed was an inverse or transposed factor analysis of the data. Inverse factor analysis is perhaps the oldest empirical grouping procedure[6]

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[5]L. J. Cronbach and G. C. Gleser, "Assessing Similarity of Profiles," Psychological Bulletin, 49, (1952), pp. 499-520.

[6]W. Stephenson, "Correlating Persons Instead of Tests," Character and Personality, 4, (1935), pp. 17-24; and C. L. Burt, "Correlations Between Persons," British Journal of Psychology, 28, (1937), pp. 59-96.

and has had reasonably widespread use. This is one reason for employing inverse factor analysis. Since the factor analytic procedure is based upon the product-moment correlation, only information regarding similarity of shape is utilized. Information about the elevation and the scatter of the patterns is lost because the product-moment correlation reduces the data to standard scores. Consequently, persons may group together because of a similarity in shape even when one person has considerably stronger and one or more variable measures than does the other person. However, because the data used in this analysis are time percentages, patterns which tend to differ in elevations (i.e., relative amount of time performing the various events) will also tend to differ in shape. Thus, because of the particular data involved, the inverse factor analysis becomes a stronger technique than it is normally.

It was noted earlier that the ratio of 36 teachers to 45 variables was in the wrong direction to perform a regular factor analysis. It was in the correct direction for the inverse factor analysis, but the ratio is still not large enough to produce factors which can be considered highly stable. The ratio was slightly improved by limiting the factor analysis to only the 24 high school teachers rather than to all 36 teachers. This technique does not permit statistical inferences to be made about the population from which the sample was drawn. Rather, the resultant groups are only descriptive of the particular sample.

The normalized percentage time measures on the 45 categories were used as input to the inverse factor analysis.[7] A principle components solution was obtained and the eight resultant factors with eigenvalues equal to or greater than one (Kaiser's rule) were rotated to varimax criterion. Table 4-16 presents the rotated factors together with some descriptive information on the teachers and the teaching situation. (Department names and exact ages are not used in the table so that teacher anonymity is maintained.) It is assumed that most clusterings of teachers produced by an inverse factor analysis of behavioral data would have some identifiable characteristics in common in addition to their classroom behavioral patterns. Probably the main characteristics held in common would be attitudes, philosophies, and other personality variables. However, such data were not gathered during the study and is not entirely pertinent to a description

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[7] The factor analytic program employed was a slightly modified version of one developed by International Business Machines, Inc.

DEPARTMENT	TEACHER	FACTORS[a] I	II	III	IV	V	VI	VII	VIII	TEACHER CHARACTERISTICS SEX	AGE GROUP	HIRED LAST THREE YEARS	PREDOMINANT[c] INSTRUCTIONAL METHOD
A	1				.79					M	C	Yes	1
	2	.53	.43							M	C	No	1
	3		.58							M	B	No	1
	4							.87		F	C	No	1
	5		.59							M	A	No	1
B	6	-.37				-.57				F	A	Yes	1
	7		.49						.36	M	A	Yes	(1)
	8					.67				M	B	No	(4)
	9			.67				.41		F	C	Yes	(3)
C	10				.55				.44	F	B	Yes	–
	11						.81			M	C	Yes	(2)
	12	-.55				-.41		.47		M	A	Yes	–
D	13		-.37			-.68				M	C	No	2
	14		-.35			-.73				M	A	Yes	2
	15				-.47	-.44				M	B	No	2
E	16	.81								M	B	No	3
	17	.70					.35			F	C	Yes	4
	18	.48	.46							M	B	Yes	1
	19		-.79							M	B	Yes	2
F	20								.81	F	A	No	(4)
	21			.54					.52	F	A	Yes	(1)
	22			-.80						M	C	No	2
	23					.68				F	A	Yes	–
	24				-.68				.35	M	B	Yes	2

[a] Only loadings having an absolute value of .35 or greater are reported.
[b] Age group codes are as follows: A = 21 - 30; B = 31 - 40; C = 41 - 50.
[c] Predominant Instructional Method codes are :

1. LAPs
2. Traditional
3. Non-LAP-Individualized
4. Mixed

( ) means other methods occur besides the predominant method.
– means that no method is clearly predominant.

TEACHERS LOADING ON INVERSE FACTOR ANALYSIS

Table 4 - 16

of the Nova teachers' management characteristics. (As discussed in Chapter II, attitudinal data on the Nova teachers is being collected by an independent study and will be available later.) In the absence of attitudinal data, the clusterings of teachers were studied for similarities of demographic and situational characteristics, although only limited data were available for such variables. As discussed previously, the principal concern is with the situational variables--particularly with individualized teaching situations.

As can be determined from Table 4-16, only Factor II can be clearly seen as having identifiable characteristics in common. All of the high loadings on Factor II are men; the five positive loadings are based upon observations taken in classes which were totally on LAPs and the three negative loadings are based upon observations taken in classes which were totally traditional with the teacher in front of the classes teaching the entire group. The tendency for some homogeneity along department lines within the positive loadings and also within the negative loadings is probably a function of whether the departments do or do not use LAPs. However, it is not conclusive that departments do not independently influence this factor.

Within the remaining factors, there are some patterns, but they are not definite. In Factor I, three of the four positive loadings are in one department. In Factor III, the two positive loadings are females who were hired in the last three years, while the negative loadings are males who have been in the system for longer than three years. All three loadings (positive and negative) in Factor IV are teachers who have been hired during the past three years. In Factor V, three of the five negative loadings are teachers in the same department. Both loadings on Factor VI are teachers in their 40's who were hired during the last two years. In Factor VII, both positive loadings are females in the 41-50 age group and the single negative loading is a male in the 21-30 age group. On Factor VIII, three of the five loadings (all positive) are in the same department, and four of the five have been hired in the last three years. In addition, the three highest loadings are young females. Thus, there are several different patterns of characteristics discernable on the factors, but they all could be coincidental or spurious.

Interpreted in light of the available information about the teachers and the teaching situation, little conclusive information emerges. While there are several trends in various factors, the limited number of high loadings prevent labeling those factors. Factor II is the only factor in which a reasonable amount of confidence can be placed in the interpretation. It seems to clearly polarize on a LAP versus Traditional basis. However, neither all LAP teachers nor all Traditional teachers are included. The specific behavioral characteristics or profiles of the teachers who load on Factor II are not readily apparent. While profiles can be plotted for each of the teachers, the number of variables and the arbitrary order in which they are arranged tend to prevent visual determination of trends.

The means and standard deviations of the variables for each of the eight teachers in Factor II are presented in Table 4-17. The intercorrelations of the eight teachers are also reported. Examination of the means reveals that all the teachers who have positive loadings on Factor II have means which are higher than zero. On the other hand, two of the three teachers with negative loadings have means below zero; the third teacher in this group has a mean above zero but below all but one of the means of the teachers with positive loadings. Hence, in general, the means of vectors for the LAP teachers on the 45 selected events are all above the total mean of one for all the teachers (since the mean of each variable vector is one because the scores are standardized, the overall mean of the teachers is also one). The Traditional teachers, however, tend to be below one (two of the three).

Since prior to normalizing, the data were expressed in percent time of occurrence of the selected events, the raw data on the 45 categories summed to 100%. If the raw data totals for each teacher had been used to calculate the means, all of the means would be identical (except for rounding errors) because 100% would have been divided by 45 in every case. Since the means are not identical, the differences must be due to the normalizing operation. For the mean of a teacher's normalized score vector to be lower than zero, many of the categories which were high in percent time in the raw data would have to be lower than many of the other teachers in that category. For the mean to be higher than zero, the reverse situation must prevail. In general, this would imply that teachers with normalized means lower than zero had less variability in the time spent in the various categories than did teachers with normalized means above zero.

(3) Hierarchical Grouping Procedure

The second grouping procedure is a hierarchical one in which groups are formed by minimizing within-group

	TEACHER	MEAN	STANDARD DEVIATION	INTERCORRELATION COEFFICIENTS						
				3	5	7	18	13	14	19
POSITIVE LOADINGS	2	.088	.926	.21	.39	-.05	.26	-.34	-.34	-.22
	3	.153	.815		.27	.37	.16	-.15	-.08	-.29
	5	.002	.979			.27	.34	-.36	-.28	-.29
	7	.069	.724				.04	-.05	.10	-.30
	18	.338	.782					-.13	-.28	-.31
NEGATIVE LOADINGS	13	-.297	.867						.54	.29
	14	-.238	.766							.30
	19	.019	.639							

MEANS, STANDARD DEVIATIONS, AND INTERCORRELATIONS FOR THE VARIABLE VECTORS OF THE EIGHT TEACHERS LOADING ON FACTOR II.

Table 4 - 17

variation and maximizing between-group variation by considering all the possible groupings of the variable profiles.[8] This approach assumes that the greatest amount of information is available prior to grouping. The procedure first groups the two people which, when combined, reduce the information available the least. During successive iterations, one person is added each time to the group in which the information loss is minimized until eventually all people have been grouped in a single group. The criterion of information loss is the error sum of squares (i.e., within variation) of the groups formed. As the error sum of squares increases in value, the information available in the groupings decreases in amount.

Prior to grouping, there is no error within the "groups;" the error sums of squares is zero. The first iteration will then combine the two profiles (e.g., the variables for individual teachers) which produce the least amount of within variance (error sum of squares). It is important to realize that the error criterion is based upon the scatter about the mean of each variable within groups rather than about the centroid of all variables within the groups. In other words, the within homogeneity across the variables in a group is not a factor in determining the error sum of squares. Thus, to a large extent, information about the shape of the profiles is utilized also in the determination of groups.

An important consideration in the use of the hierarchical grouping procedure is that each variable is given the same opportunity to influence the error sum of squares within a group. No matter how extensively the variables intercorrelate, each will contribute to the resultant group as if it were independent. Consequently, the inclusion of related variables will disproportionately influence the groupings. This characteristic is not present in the inverse factor analysis procedure since factor analysis is based on an intercorrelation matrix.

Another consideration is that variables with larger variances will contribute more to the error sum of squares criterion than will variables with smaller variances. Again, because factor analysis is based upon product moment correlations, this factor is not present in the

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[8] Joe H. Ward, Jr., Hierarchical Grouping to Maximize Payoff. (Lockland Air Force Base, Texas: Personnel Laboratory, Wright Air Development Division, Air Research and Development Command, USAF, March, 1961.) (Technical Note WADD-TN-61-29); "Hierarchical Grouping to Optimize an Objective Function," Journal of the American Statistical Association, 58, (1963), pp. 236-244.

inverse factor analysis. In the applications of the hierarchical procedure to the observational data on the teachers, this problem was not present because the data were standardized prior to grouping (thus, all the variables have a variance of one).

As is true with the inverse factor analysis, no test of significance exists to determine the stability of the resultant groups. Consequently, both procedures are only applicable to descriptive uses and the results only have meaning for the particular sample studied. No inferences can be made about the teachers in the Nova Schools who are not included in the sample.

This method of grouping, then, employs the similarity component of scatter and consequently the component of elevation and, to some extent, that of shape. Thus, it differs from the inverse factor analysis which employs shape and, because of the particular data, elevation to some extent but not scatter. While the hierarchical method provides an indication of which profiles are similar, it apparently does not form optimal groups[9] and there is some evidence that it does not produce stable results.[10]

The application of the hierarchical grouping procedure with the observational (RO_1) data was to provide information which could not be provided by the inverse factor analysis. The factor analysis used all 45 variable categories and more categories would have been desirable to produce more stable results. The number of variables employed with the hierarchical grouping procedure, however, is in no way crucial to the procedure. Consequently, a few variables can be considered as well as a lot. Utilization of this procedure, then, permits an examination of a limited number of variables which are logically related. The inverse factor analysis did not permit this flexibility.

After examining the eight groups of teachers produced by the inverse factor analysis (which is described in the preceding section), it was hypothesized that the groups might form differently if only certain variables were considered instead of all the variables. Also, it is of interest to look at certain classes of events which logically seem to relate to the degree of individualization

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[9] Ward, Ibid.; Veldman, op. cit.

[10] Lyle R. Schoenfeld, The Grouping of Subjects into Homogeneous Subsets: A Comparison and Evaluation of the Divergent Approaches. Unpublished doctoral dissertation (Lafayette, Indiana: Purdue University, 1966.)

of instruction. Since factor analysis was no longer appropriate, the hierarchical procedure discussed above was used. Since the ratio of variables to subjects was no longer crucial, data on all 36 teachers were used as input to the grouping procedure. As in the factor analysis, normalized percent time was used as the variable measures.

Selected events were placed in three logical groups where each deals with a particular class of events. One group is comprised of events which primarily involve logistics and maintenance activities (numbers 1301, 1303, 2301, 2304, 2305, 2306, 2718, 1731, 2731, 2302, 2303, 2706, 2201, and 1201). The second group contains events dealing with affective behaviors (numbers 3701, 2721, 2701, 3703, 3707, 1708, 2708, 2714, 3708, 3712, 3713, 3723, 3724, 3727, 3732, 3733, 1716); and the third group contains events dealing primarily with rewards and punishment (numbers 1701, 1709, 1715, 1721, 2701, 2721, 3701, 2709, and 2702). A separate run was made for each set of variables with the hierarchical grouping procedure. Thus, while the inverse factor analysis was used with all 45 variables in a single computer program pass,[11] the hierarchical grouping procedure was used with three separate groups of variables, each of which tends to be at least logically homogeneous.

Since the procedure employed in hierarchical grouping goes through n-1 iterations, and thus forms n-1 different sets of groups where each successive set has an increased error sum of squares, there is no single end product one can examine. The investigator's interest is in one or more of the sets of groups which lie between the original n sets of ungrouped data and the final set in which all the people have been grouped into a single set. Since the error sum of squares does increase with each iteration, it provides an index which can be used as a guide in interpreting the results. However, it can only be used as a guide--there are no criteria by which its magnitude can be used to indicate which groupings should be examined or used for interpretation. When a large increase occurs in the magnitude of the error sum of squares, it implies that substantial information has been lost in the newest grouping. In general, the grouping just prior to a large, or to the largest, error increase is particularly worthy of study.

In each of the three runs of the grouping program, the set of groups which was selected for further study was one which had a substantially large increase in error sum of squares for the following iteration. For the run on the affective variables, the increase in error sum of

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[11]The program was adapted from Veldman, Op Cit.

squares for the set selected was the largest increase which occurred. In the other two runs, the error sum of squares for the set selected was not the largest; the largest occurred when three groups were combined to make two groups in the final combining operation of the run. Consequently, sets which contained more groups and had a smaller error associated with them were chosen.

Table 4-18 contains the groups obtained for the logistics and maintenance variables. Table 4-19 presents the groups obtained for the affective variables and for the reward and punishment variables. In both tables, the composition of the groups is presented in terms of the number of teachers in each of the four teaching situations and the number of teachers in each of the high school departments and in the two elementary schools. The general conclusion that can be reached from Table 4-18 is that for the logistics and maintenance variables, the teachers tend to group according to the teaching situation. Group 3 in Table 4-18 has three of the four teachers in the LAP situation. Group 4 has all three of its teachers in the Mixed situation (since the Mixed situation is by definition eclectic, a grouping of three of the Mixed-situation teachers into the same group may be meaningless). In Group 5, half of the teachers grouped in the LAP situation and the other half grouped in the non-LAP individualized situation. Thus, all six teachers in Group 5 are individualized teachers. Group 6 in this table has six of the seven teachers in the Traditional situation and the seventh teacher is in the Mixed situation. The remaining groups in Table 4-18 do not have any apparent structure according to either situation or to instructional division. However, five of the six remaining groups contain three teachers or less and two of those contain only single teachers. Therefore, the lack of an emergent pattern may be only because of the small number of teachers involved.

For the affective variables and for the reward and punishment variables, no particular patterns emerge by either the teaching situation or by the instructional division. For the rewards and punishment variables, there is a slight tendency for the elementary school teachers to group together. For example, Groups 5 and 6 are predominantly composed of elementary teachers, and five of the remaining teachers are grouped into Group 3. It would appear, then, that teacher characteristics associated with the grouping of the affective variables and of the reward and punishment variables are not strictly situation related. It is quite probable that these groups have in common teacher characteristics more related to the teacher's personality and to the teacher's attitudes than to other

GROUPS	NUMBER OF TEACHERS IN GROUP	TEACHING SITUATION IN WHICH MAJORITY OF EACH TEACHER'S OBSERVATIONS FELL					INSTRUCTIONAL DIVISIONS							
							HIGH SCHOOL						ELEMENTARY	
		LAP	TRADITIONAL	NON-LAP INDIVIDUALIZED	MIXED	NO CLEAR MAJORITY	SCIENCE	MATH	LANGUAGE	ENGLISH	SOCIAL STUDIES	TECH. SCIENCE	NOVA I	NOVA II
1	3	1	1		1		1			1			1	
2	3	1		2			1							2
3	4	3		1			1					2	1	
4	3				3		2	1						
5	7	3		3		1		2		1	1		2	1
6	7		6		1			1	3	2		1		
7	3	2	1								1		2	
8	4		2	1		1					1		2	1
9	1				1							1		
10	1					1				1				

HIERARCHICAL GROUPING: SITUATIONAL AND DIVISIONAL COMPOSITION OF GROUPS FORMED USING LOGISTICAL AND MAINTENANCE VARIABLES

Table 4 - 18

			TEACHING SITUATION IN WHICH THE MAJORITY OF EACH TEACHER'S OBSERVATIONS FELL					INSTRUCTIONAL DIVISIONS							
								HIGH SCHOOL						ELEM.	
	GROUPS	GROUP	LAP	TRADITIONAL	NON-LAP INDIVIDUALIZED	MIXED	NO CLEAR MAJORITY	SCIENCE	MATHEMATICS	LANGUAGE	ENGLISH	SOCIAL STUDIES	TECH. SCIENCE	NOVA I	NOVA II
A	1	7	2	2	1	1	1	1	2	2		1			1
	2	10	4	4	2			1	1	1	1			5	1
	3	2	1	1				1			1				
	4	6	2	1	1	1	1	1			1	1	1	1	1
	5	4	3		1			1					1	1	1
	6	4	1		2	1			1				2	1	
	7	3		2			1				2	1			
B	1	10	4	2	1	2	1	3	1	1		2	2		1
	2	8	2	4		1	1	1	1	2	3	1			
	3	9	5	2	2			1	2		1			4	1
	4	2			1		1				1		1		
	5	5	2	1	2								1	2	2
	6	2		1	1									2	

A - Affective Variables

B - Reward and Punishment Variable

HIERACHICAL GROUPING: SITUATIONAL AND DIVISIONAL COMPOSITION OF GROUPS FORMED USING AFFECTIVE VARIABLES AND REWARD AND PUNISHMENT VARIABLES

TABLE 4-19

variables. It is important to note that the teaching situation per se did not strongly influence patterns of variables such as the affective and the reward and punishment ones.

COMPARISON OF CLASSROOM CHARACTERISTICS

ACROSS TEACHING SITUATION

The preceding analyses in this chapter have been concerned with the comparison of teachers in both a priori and empirical groups on many variables. The analyses which follow in this section are primarily concerned with the comparison of specific limited aspects of the teachers' behavior across teaching situations.

1. Student-Teacher Interactions

Since a primary goal of individualized instruction is to provide each student with the help he needs, it is of interest to see how many students interact with the teacher during a class. While many functional definitions of individualized instruction do not involve excessive interactions between students and teachers, such interactions can be a prime method of student assessment, as well as a standard method of imparting information.

Table 4-20 presents summary information from the RO_2 about the single student-teacher interactions by teaching situation for the high school and the elementary schools (the frequencies from which Table 4-20 was prepared are presented in tables in Appendix C). The percent (average) of students in the class with whom the teacher interacted shows only slight variation across situations. In both the high school and the elementary school, the Traditional situations have a lower percentage of single interactions with students than in any of the other situations. This seems to reflect the difference in approach of the Traditional classes from the Individualized and Mixed classes, but the difference in percentages is not as great as might be anticipated. Since the teacher in the Traditional class spends a large amount of time with the whole class (see earlier discussion of teacher interaction with single students, small groups, and the whole class). Also, the standard deviations for the Traditional classes are slightly higher than for the Individualized and Mixed classes, which indicates more variability in these classes. However, the situation is more complex than is immediately apparent, as is discussed below.

Another measure of interaction reported in Table 4-20 is the average number of interactions per minute. Since the

School: Situation:		H S 1	H S 2	H S 3	H S 4	ELEM. 1	ELEM. 2	ELEM. 3
No. of Observations:		19	20	8	7	3	4	10
No. of Students for whom Teacher was Responsible:	M	30.26	30.15	25.00	32.14	24.66	32.25	22.30
	S.D.	9.11	20.66	4.36	11.14	6.78	14.93	9.54
	R	35	98	12	34	13	32	30
No. of Students with whom Teacher Interacted:	M	20.10	16.20	19.25	23.85	20.66	18.75	15.90
	S.D.	5.20	7.07	5.39	10.00	12.41	5.00	5.00
	R	17	28	17	29	22	12	28
% of Students in Class with whom Teacher Interacted	M	70.47	61.30	76.25	76.71	67.33	63.25	73.00
	S.D.	23.35	25.53	17.09	20.20	21.21	21.66	21.31
	R	63	93	50	48	39	45	68
Total Interactions Initiated by: Teacher:	M	19.26	21.00	17.62	16.85	8.33	14.50	15.80
	S.D.	10.05	13.71	6.78	9.49	7.75	5.20	17.49
	R	34	52	22	27	15	12	57
Student:	M	21.94	11.70	21.37	17.57	27.33	11.50	27.00
	S.D	12.37	8.12	11.27	9.22	11.58	2.45	18.87
	R	47	25	31	25	23	6	49
% of Interactions Initiated by Student:	M	51.89	33.75	54.50	56.71	79.66	45.00	65.30
	S.D	17.64	21.77	21.19	21.40	9.70	13.75	25.28
	R	65	71	44	60	19	31	77
Length of Observation (in Minutes):	M	43.00	35.85	41.00	55.28	30.66	22.50	29.90
	S.D.	15.33	14.80	16.91	13.08	1.15	3.32	2.24
	R	40	46	39	33	2	7	9
Average No. of Interactions Per Minute:	M	.50	.50	.54	.42	.68	.84	.53
	S.D.	.67	.53	.60	.13	.42	1.00	.26
	R	.67	.67	.66	.38	.74	.60	.79

Abbreviations Used:

Situation 1 - LAP Classes
Situation 2 - Traditional Classes
Situation 3 - Non-LAP Individualized Classes
Situation 4 - Mixed Classes

H S - Nova High School
ELEM- Nova Elementary Schools
M - Mean
S.D. - Standard Deviation
R - Range

MEANS, STANDARD DEVIATIONS & RANGES OF SINGLE STUDENT-TEACHER INTERACTIONS AND FREQUENCIES[a]

Table 4 - 20

[a] Excluding brief disciplinary and/or control interactions.

length of the observations vary, the number of interactions which can be accomplished in a class is in part a function of time. (While the comparison of the percent of student-initiated interactions is only minorly affected by the time period, the actual number of interactions can be meaningfully compared across situations.) Consequently, the average number of interactions per minute is used to give a basis for comparison across situations. It should be noted that this figure does not imply the average duration of teacher-student interactions, but only the density in time of those interactions.

Within the high school, there is only slight variation in the average number of interactions across the four situations, the Mixed situation being the lowest. The LAP and the Traditional situations in the high school have identical average number of interactions per minute, yet the LAP class had a higher percentage of students involved in interactions than did the Traditional classes. Examination of the average length of the observations shows that the observations in the LAP classes tended to be longer than those in the Traditional (because of the observer rather than the situation). These data collectively suggest that the difference in the percent of students with whom the teacher interacted is more a function of the duration of the class than of the situation. A similar situation occurs in the elementary schools, but there are more interactions per minute there for Traditional than for LAP classes.

The evidence provided by the average-number-of-interactions-per-minute index, then, indicates that for a unit of time, as many or more single student-teacher interactions occur in Traditional situations as in LAP situations. Yet, teachers in the Traditional situations spend at least half of their time interacting with the whole class. The explanation of the discrepancy lies in the nature of the single student-teacher interactions. In the Traditional class, directed verbal exchanges between a student and the teacher were recorded as single student-teacher interactions even if the teacher was standing in front of the class and all of the other students were listening. In the LAP classes, very few such exchanges took place. Consequently, the high frequency of single interactions in the Traditional class seems to be because the interactions differed in kind from those in the Individualized situations.

A more revealing comparison across the four situations is the percentage of the interactions which were student initiated. The differences between the Traditional and the LAP situation on percentage of student-initiated interactions reflect the difference between the nature of the interactions in the two situations. In the Traditional high school situation, two-thirds of the interactions were teacher-initiated, while only about half of those in LAP situations were teacher-initiated. Hence in the LAP classes, students talk to the teacher more because they want to talk to him or because they need to talk to him, than in the Traditional class. In the Traditional classes, the teacher tends to talk to the students because he wants to talk to them.

The similarity between the LAP and the Traditional situation on student initiations suggests that the LAP *per se* is not requisite for student-initiated interactions to occur more than teacher-initiated ones. For the high school, only a third (33.75%) of the Traditional class interactions were initiated by the student. For the elementary schools, 45.0% of the interactions were initiated by the students. In the other classes, from 51.89% to 79.66% of the interactions were student initiated. In the high school, the highest percentage of interactions initiated by students occurred in the Mixed situation, a result which is not readily explainable.

2. Queueing of Students Waiting for Teacher Attention

In the preceding section, the frequency of student-teacher interactions was discussed and several differences were noted in the four teaching situations. One of the constraints on the teacher interacting with students on a one-to-one basis is that not enough time is available for extensive interactions with a large number of students in a regular class period. The question can be asked: "How many students want to see the teacher but have to wait for him for a period of time?" The number of students who actively sought the teacher's attention, but who had to wait to interact with him, was recorded on the RO_2 instrument and summary figures are presented in Table 4-21. Only students who waited approximately fifteen seconds or longer after they overtly sought his attention were recorded as having to wait for the teacher's attention. Table 4-21 does not reflect the number of students who were actually seen by the teacher, but only those who were waiting for him.

The principal summary figure in Table 4-21 is the average percentage of students who have to wait for fifteen seconds or longer. This percentage is obtained by dividing the average number of students per observation into the average number of students who wait per observation. It does not reflect the length of the wait, but only if the wait occurred. The average percent of students who waited in the LAP situation was 24%, while the average percent of students who waited in the Traditional situation was only 6.4%. This difference would seem to reflect the nature of the student interactions with the teacher as was discussed in the preceding section. In the

	LAP	TRADITIONAL	NON-LAP	MIXED	TOTAL
No. of Observations	22	21	8	6	57
Average No. of Students	32.9	34.2	23.4	31.3	1818
Average Length of Wait					
15 Sec. - 1 Min.	115	28	59	27	[illegible]
1	14	5	10	2	[illegible]
2	9	4		13	[illegible]
3	13	1		3	17
4	5		6		11
5	2		3		5
6	4				4
7	1				1
8	5				5
9	1				1
10					
11					
12			2		2
13	1		1		2
Total Seen:	170	38	81	45	[illegible]
No Attention:	3	8	8	5	[illegible]
Total:	173	46	89	50	[illegible]
Aver. % of Students who Waited:	24.0	6.4	46.2	26.5	
Aver. No. waiting per observation:	7.9	2.2	10.8	8.3	

QUEUEING OF STUDENTS FOR TEACHER ATTENTION
BY TEACHING SITUATION

Table 4 - 21

Traditional class, the interactions are frequently directed conversation between the student and the teacher in front of the whole class--that is, the other students in the class are generally listening to the interaction, rather than working on other things. In the LAP class, most of the interactions are accounted for by conversations between the student and the teacher which do not involve the remainder of the class. Consequently, because of the nature of the interactions, the formation of observable queues in the Traditional class is considerably less than in the LAP class.

In the Non-LAP-Individualized situation, the average percentage of students who have to wait is 46.2%. This is almost twice as many as in the LAP situation. The difference is probably in part due to the structure imposed by the LAP on the student in the LAP situation. The LAP structures the student's learning experiences and should minimize the number of needed student-teacher interactions. The Non-LAP-Individualized class does not have the structure that is imposed by the LAP and, consequently, the teacher must personally direct the majority of the learning experiences. The percentage for the Mixed situations of 26.5% is, as in other figures for the situation, reflective of the eclectic nature of the category.

The distribution of the length of wait visably varies across the four situations. The mean length of wait has not been calculated because the beginning category ranges from fifteen seconds to one minute and the no-attention category can vary in length from the entire class period to a very few minutes at the end of the period. The majority of the waits, and therefore the median wait, is from fifteen seconds to one minute in all four situations; however, both the Individualized situations (LAP and Non-LAP) have distributions of waiting time which extend much longer than those in the Traditional situation. Again, this difference is probably due to the different nature of the interactions in the two situations as was discussed above.

3. Incidents of Giving Grades in Class

One of the non-instructional activities which frequently takes place during a class is informing students of their grades for a test or study unit. In one respect, giving grades can be considered to consume time which might be otherwise spent on instruction or other activities. However, grading can also be considered as motivational feedback and, if used properly, can contribute to the instructional goals of the class.

Since giving grades involves time which is not being used for instruction, the RO_1 observations were examined to determine the prevalence of giving grades in class and the amount of time involved. Grades are coded under the category 1723 on the RO_1 and can be distinguished from other events in that category by an additional code. (The entire 1723 category loaded high on a discriminant root which significantly separated LAP classes from Traditional classes--see previous discussion.) The data on each observation were searched by a computer program to determine the frequency and time spent in grading.

Of the 39 observations in LAP situations, incidents of grading occurred in fourteen or 35.9% of them, while of the 33 observations in Traditional situations, incidents of grading occurred in only four or 12.1% of them. Four or 16.7% of the 24 Non-LAP-Individualized observations had grading events and two or 20% of the ten Mixed situations contained grading activities. Since there are multiple observations for most of the teachers, figures on the number of teachers who graded in each group were also obtained. Nine or 56.2% of the sixteen teachers in the LAP classes, three or 18.8% of the sixteen teachers in the Traditional classes, three or 25.0% of the twelve teachers in the Non-LAP-Individualized, and two or 33.3% of the six teachers in the Mixed situations were engaged in grading activities during the observations. These percentages are ranked in the same order as the percentages of individual classes involving grading reported above.

The percentages of teachers is confounded slightly since eleven teachers have observations occurring in two or three of the teaching situations, instead of just one. Only three or 27.3% of these multiple-situation teachers grade in all of the classes observed, and six or 54.5% of these teachers grade in at least one of the classes in which they were observed. For comparison, 44.0% of the single-situation teachers grade in one or more of the classes in which they were observed. Thus, the teachers who were observed in multiple situations engaged in grading activities more than those who were observed in single situations. This finding, however, may be an artifact of the distribution of multiple situation teachers across the four situations rather than a function of the multiple-situation factor.

The data suggest that teachers in LAP situations more often engage in grading activities during class than do teachers in Traditional classes by a ratio of 3 to 1. There are several possible explanations for this finding. Since the teachers in the Traditional classes are involved in group instruction, it is probably more difficult for them to give out grades during the class. If this is the only factor, teachers in the Non-LAP-Individualized classes should be as high as those in the LAP classes in grading frequency. This, however, is not the case; teachers in Non-LAP-Individualized classes grade only slightly more often than do Traditional class teachers (25.0% versus 18.8%) and less than half as often as LAP teachers.

Another reason might be that the LAPs are intended to structure the classroom situation in such a way that grading (or providing feedback on assessed behavior) is required more frequently than in non-LAP situations. If the LAP structures the situation in such a way as to force more grading, those teachers who teach in the multiple situations should grade more frequently when they are in a LAP situation than when they are in the other situations. Of the six teachers who taught in multiple situations and who graded in at least one of those situations, four had at least one observation in the LAP situation. One of the four graded in the LAP situation and not in another situation, while one of the four graded only in a non-LAP situation. Collectively, these teachers had seven observations in the LAP situation and six in other situations. Of these, five or 71% of those in LAP classes gave grades and four or 67% in other classes gave grades. This information, then, provides no support for the hypothesis that the LAP structures more grading; however, because of the small number involved, it should not be considered as strong evidence against that hypothesis.

CHARACTERISTICS OF INDIVIDUALIZED

HIGH SCHOOL CLASSES

The analyses in the remainder of this chapter will be primarily concerned with identifying and describing the characteristics of the LAP classes and the Non-LAP-Individualized classes in Nova High School. The chief concern of the study is with individualized teaching situations. Further, since it is anticipated that if future phases of the project becomereality, they will be concerned solely with the high school, it is logical that the descriptive effort should be limited to the individualized high school class. This narrowing in no way minimizes the importance of or the need for describing the individualized elementary classroom.

Many aspects of the Individualized class can be considered for description. In fact, with the extensive data collected, analyses could be continued almost ad infinitum. The specific aspects of the Individualized class which are included in this section reflect the project's primary concern with the teacher as the classroom manager. Even within this narrowed approach, only a very few of the many possible ways in which the data could be examined have been explored. The analyses presented are ones which particularly reveal interesting and important patterns in the teacher's management characteristics.

Tenor of Individualized Classes

One manner in which a class can be described is in terms of its general orientation toward the activities which are undertaken during the class. For example, if most of the activities are related to subject matter and student acquisition of knowledge, the tenor of the class would be different than if most of the time was spent on systems problems or other activities unrelated to subject matter. Since in a LAP class many of the subject matter concerns are handled by the LAP itself, it is of interest to see what percentage of the teacher's activities are spent in relation to subject matter problems as opposed to other problems. The RO_1 instrument classified events which are subject matter oriented in the 1000 series, events which are systems oriented in the 2000 series, and events which are affective oriented in the 3000 series.

Table 4-22 presents the percentage of events which fall into these three general groupings for the high school teachers in the LAP situation and for the high school teachers in the Non-LAP-Individualized situation. Even though the LAP teacher is intended to direct the student in subject matter acquisition, the average LAP teacher spends 62% of his time in subject matter concerns. This is only slightly less than the Non-LAP-Individualized teacher who spends 68% of his time in subject matter concerns even though he does not have the benefit of the LAP to aid him in presenting material to the students. This would indicate that the general activities associated with presenting subject matter are only slightly diminished in number by the introduction of the LAP although they quite probably are of a different nature.

The average LAP teacher spends 36% of his time in systems supportive activities, while the Non-LAP-Individualized teacher spends 29% in systems activities. Thus, the time gained by the LAP teacher by having the LAP is apparently devoted to systems concerns. In both situations, only 2% of the teacher's time is spent in affective activities.

Individual variation within the two teaching situations can be seen reflected in the standard deviations reported in the table. The standard deviations for the Non-LAP-Individualized teachers are slightly lower than those for the LAP teachers, suggesting that the non-LAP situation is slightly more homogeneous and both of these are in the LAP situation--again indicating more variability in that case.

SITUATION	TEACHER	NUMBER OF OBSERVATIONS	SUBJECT MATTER EVENTS (1000)	SYSTEM EVENTS (2000)	AFFECTIVE EVENTS (3000)
LAP INDIVID- IZED	1	3	59	38	3
	2	1	81	19	-
	3	2	56	44	0
	4	3	71	28	0
	5	3	68	32	0
	6	1	96	4	-
	7	3	40	59	1
	8	3	57	41	2
	9	3	64	33	2
	10	1	40	57	4
	11	1	52	42	6
	12	1	64	35	0
MEAN	—	2.1	62	36	2
STANDARD DEVIATION	—	—	15.9	15.1	2.0
NON-LAP INDIVID- UALIZED	1	3	57	36	7
	2	1	63	37	-
	3	1	61	38	1
	4	2	64	34	2
	5	1	70	24	5
	6	1	93	7	-
MEAN	—	1.5	68	29	2
STANDARD DEVIATION	—	—	13.0	12.1	2.8

PERCENT OF TIME INVOLVED IN SUBJECT MATTER, SYSTEM, AND EFFECTIVE EVENTS WITHIN TWO SITUATIONS.

Table 4 - 22

Classroom Traffic Control

Part of any classroom teacher's daily activities are involved in traffic control problems, including calling roll, giving students permission to go somewhere, or other events in which the teacher is required to control the whereabouts of students. Prompted by one LAP teacher's comment that all he did was take roll and permit students to go to the restroom, it was decided to investigage the extent of traffic control events in individualized instructional settings. Traffic control is coded on the RO_1 in the category 2710; roll call and asking students where they have been is included in this category, since these activities are part of controlling the students whereabouts. In the section on the discriminant analyses, it was reported that traffic control loaded high on a root which separated LAP and Traditional classes. In those analyses, the elementary teachers were also included.

Table 4-23 presents the extent of time involved in traffic control events for the LAP Individualized class and for the Non-Lap-Individualized class. Also included in the table are the number of students for each teacher and the average percent time of 2710's per individual student. In the LAP situation, an average of 8% of the teacher's time is spent in traffic control activities, while in the Non-LAP situation, only 3% of the teacher's time is spent in traffic control activities. However, the average number of students in the LAP classes is 33, while the average in the Non-LAP classes is only 20; thus, a differential in the percent of time spent in traffic control is to be expected. When the average percent time per student is examined, however, it reveals that .28% of a teacher's time in the LAP situation is spent in traffic control for each individual student, while in the Non-LAP class, only .09% of the teacher's time is spent in traffic control for the individual student. These data then reveal that, while the overall percent of class time actually spent in traffic control is low, there is more time spent by the LAP teacher than by the Non-LAP teacher. Examination of the percent time spent by the individual teachers shows that some teachers spend no time in traffic control activities, while at least one teacher spends as much as 17% of his time on traffic control during the observation recorded. Also, half of the six Non-Lap-Individualized teachers have no traffic control events at all, again illustrating the low occurrence of 2710's in the Non-LAP situation.

Table 4-24 presents the breakdown of the events which are recorded under 2710 for the particular teachers in the two situations. All of the events fall in four general categories. These are: roll call, asking why the student is late, giving permission to the student to go somewhere, and giving directions to the student about signing out. The distribution of 2710's across these categories is reasonably uniform for both the LAP and the Non-LAP situations. In both cases, the highest

SITUATION	TEACHER	NUMBER OF OBSERVATIONS	AVERAGE NUMBER OF STUDENTS	AVERAGE PERCENT TIME	AVERAGE PERCENT TIME PER STUDENT
LAP - INDIVID- UALIZED:	1	3	24	3	.12
	2	1	20	17	.85
	3	2	26	6	.23
	4	3	25	3	.12
	5	3	27	9	.33
	6	1	30	0	.00
	7	3	25	12	.48
	8	3	25	7	.28
	9	3	24	10	.42
	10	1	41	15	.37
	11	1	75	11	.15
	12	1	53	1	.02
MEAN	-	2.1	33	8	.28
NON-LAP- INDIVID- UALIZED:	1	3	22	0	.00
	2	1	26	2	.08
	3	1	32	8	.25
	4	2	31	10	.22
	5	1	4	0	.00
	6	1	4	0	.00
MEAN	-	1.5	20	3	.09

TIME INVOLVED IN TRAFFIC CONTROL EVENTS
BY TEACHER WITHIN TWO SITUATIONS

Table 4 - 23

SITUATION		ROLL CALL	WHY ARE YOU LATE	PERMISSION TO GO	DIRECTING SIGN OUT	TOTAL	NUMBER OF OBSERVATIONS	NUMBER OF TEACHERS
LAP-INDIVIDUALIZED	FREQ.	28	39	52	15	134	25	12
	%	20.9	29.1	38.8	11.2			
NON-LAP-INDIVIDUALIZED	FREQ.	5	8	9	1	23	9	6
	%	21.7	34.8	39.1	4.3			
TOTAL	FREQ.	23	47	61	16	157	34	18
	%	21.0	29.9	38.8	10.2			

FREQUENCY AND TYPE OF TRAFFIC CONTROL EVENTS

(2710's) IN TWO TEACHING SITUATIONS

Table 4 - 24

percentage of occurrences are the teacher giving the student permission to go somewhere. The only discrepancy between the two classes is in the lowest percentages, those which occur in relation to signing out (for the LAP teacher, the percentage is 11.2 and for the Non-LAP teacher, it is 4.3).

While in some classes perhaps a disproportionate amount of time is spent on traffic control, it would seem that no teacher spends "all" of his time taking roll and permitting students to go to the restroom. In some classes, however, it would seem that more time would be available to the teacher for instructional activities if he could spend less time with traffic control.

Teacher Inquiry About Students' Need for Assistance

In the individualized instructional situation, the students frequently work on their own with limited subject matter assistance from the teacher. In preceding sections, the frequency of student-teacher interactions has been discussed and the extent to which the students initiate those interactions has been discussed. A particular concern in the individualized classes is the extent to which the teachers ask the students if they need assistance in their subject matter acquisition activities. One way in which the teacher can find out if the student needs subject matter assistance is to ask such questions as: "How are you doing?" or "Can I help you?" These are unstructured inquiries made by the teacher to informally determine if the student needs help and they differ from evaluation activities in which the teacher is attempting to assess the student's progress. Inquiries of this nature were recorded on the RO_1 instrument in category 1714. Table 4-25 contains the frequency of occurrence of 1714's for the LAP and the Non-LAP-Individualized situations. The 25 LAP observations have a mean occurrence of 2.2 inquiries of this nature and the Non-LAP-Individualized observations have a mean of 1.7 inquiries. Both of these frequencies seem low and are very similar in magnitude.

Table 4-25 also presents frequency data about how the 1714's occur in relation to other interactions. The 1714's occur in five general types of sequences. The first type is the 1714 occurring alone without subsequent teacher interaction with the same student (which usually indicates that the student did not want assistance). The second type is the 1714 occurring with another 1714 only with no other events in the same interaction sequence with that particular student. The third type is 1714's which occur at the beginning of a sequence of

	FREQUENCY OF OCCURRENCE OF 1714's											
	0	1	2	3	4	5	6	7	8	9	TOTAL	AVERAGE FREQUENCY PER CLASS
No. of Classes:	5	8	3	1	1	4	1	0	1	0	25	
LAP: LOCATION IN INTERACTION SEQUENCE:												
1. Alone		25		1		1			5		9	.40
2. W/other 1714 only						1					1	.04
3. Beginning		5	2	1	2	6	5		2		23	.92
4. Middle			2	1	1	9			1		14	.56
5. End		1	2		1	3	1				8	.32
TOTAL:	0	8	6	3	4	20	6	0	8	0	55	2.2
No. of Classes:	5	1	1	1	0	0	0	0	0	1	9	
NON-LAP: LOCATION IN INTERACTION SEQUENCE:												
1. Alone		1									1	.11
2. W/other 1714 only											0	0.0
3. Beginning			2	2							4	.44
4. Middle				1						8	9	1.0
5. End										1	1	.11
TOTAL:	0	1	2	3	0	0	0	0	0	9	15	1.7

FREQUENCY AND SEQUENCE OF TEACHER QUERYING STUDENTS
ABOUT NEED FOR SUBJECT MATTER ASSISTANCE (1714's)

Table 4 - 25

other events in a continuing interaction with a single student. The fourth type is the 1714 which occurs in the middle of a sequence of events during a single interaction with a student. The final type is the 1714 which concludes a sequence of other events which occur in an interaction with a single student. The average frequency per class for the LAP situation is highest for the third category in whic the 1714 occurs at the beginning of a sequence of events in an interaction with a student. The next highest average occurs in the middle of the sequence. Both of these frequencies indicate that a majority of the 1714's in the LAP class are responded to by the student in such a way that the interaction continues. The situation is similar in the Non-LAP-Individualized situation except that the largest average is for 1714's which occur in the middle of a sequence and the next largest is at the beginning of a sequence. However, the overall frequency of 1714 is low in both situations and extensive conclusions cannot be drawn from the limited amount of data.

Teacher Initiated Events

In the previous discussions about the teacher's activities, little attention has been paid to whether the teacher initiated a particular event or whether the student initiated it. In the discussion of student-teacher interaction, the percentage of students initiating events was discussed but the nature of the events themselves were not discussed. Since the teacher is seen as the manager of the class in the individualized situation, it is of interest to determine what proportion of the activities recorded during the observations are initiated by the teacher and what these activities are.

Table 4-26 presents the percentage of events which were initiated by the teacher. These figures are based on the frequency of events rather than the duration of events (percent time) as has been used in most of the previous discussions. For the teachers in the LAP situation, 24% of the events recorded were initiated by the teacher; while in the Non-LAP-Individualized situation, 34% were initiated by the teacher. The remainder of the events were initiated by persons other than the teacher, including students, other teachers, and administrative personnel. These figures suggest that roughly a fourth to a third of the teacher's activities are self-initiated and that the others are imposed by the system in some way.

Table 4-26 also reports the percentage of teacher initiated events which are accounted for by subject matter activities, systems activities, and affective activities. For the LAP situation, over half the teacher-initiated events (57%) are related to systems activities and only 40% are related to subject matter activities. In the Non-LAP-Individualized situation, the proportion of time is more evenly divided

				NATURE OF TEACHER INITIATED EVENTS		
Situation	Teacher	No. of Observations	Percent of Teacher Initiated Events	Subject Matter	Systems	Affective
LAP Individ-ualized	1	3	19	39	60	1
	2	1	22	74	26	0
	3	2	31	27	70	1
	4	3	21	52	48	0
	5	3	13	33	66	1
	6	1	16	73	27	0
	7	3	32	25	75	0
	8	3	19	19	78	3
	9	3	31	45	53	2
	10	1	21	17	79	3
	11	1	35	26	59	15
	12	1	31	55	43	2
MEAN	—	2.1	24	40	57	2
NON-LAP Individ-ualized	1	3	23	38	58	4
	2	1	37	39	61	0
	3	1	21	33	67	0
	4	2	35	34	67	0
	5	1	44	58	32	10
	6	1	44	94	6	0
MEAN	—	1.5	34	49	48	2

PERCENTAGE AND NATURE OF EVENTS INITIATED BY THE TEACHER IN TWO SITUATIONS

Table 4 - 26

between subject matter and systems activities, being 49% and 48%, respectively. In both situations, only 2% of the teacher-initiated events are related to affective activities.

As was the case in other comparisons between the LAP situation and the Non-LAP-Individualized situation, the difference in the nature of the teacher-initiated events may be due to the structure imposed by the LAP. Where the LAP provides structuring of the student's activities in subject matter for the LAP situation, the teacher must provide that structure in the Non-LAP-Individualized situation. Consequently, proportionately more of his time is involved with initiating activities related to subject matter performance than his counterpart in the LAP situation.

The breakdown of teacher-initiated events could be continued by levels until the events are discussed one by one. While the above discussion presents the general tone of the teacher-initiated events by broad area, an analysis at the next logical level by category number (i.e., the second digit level in the code number for the RO_1) would provide information on what specifically the teacher does within each of the broader categories.

A Comparison of Two Observations Made by the Same Teacher

In the preceding analyses of the observational data in this chapter, particular emphasis has been placed on synthesizing and summarizing of findings across teachers and across observations. Various comparisons have been made among the high school departments and the two elementary schools and among the four types of teaching situations. In reference to these comparisons, the groups have often been discussed as if they were homogeneous and as if the group mean or group centroid adequately represented every teacher in that group. Reference back to the discussion of the empirical grouping procedures will quickly convince the reader that a single parameter will not adequately represent a teacher within the *a priori* groups.

Not only are there extensive inter-teacher differences in the observational data, but there are intra-individual differences from one class to another on the same teacher. Table 4-27 presents a comparison of two different observations made on a single teacher on the same day along many of the dimensions which have been previously discussed in this chapter. In both observations, LAPs were used and the length of both observations is 25 minutes. Further, both observations were made in classes concerned with the same general subject matter.

VARIABLE	OBSERVATION 1	OBSERVATION 2
NUMBER OF STUDENTS:	23	27
LENGTH OF OBSERVATION:	25 Min.	25 Min.
PERCENT OF STUDENTS WITH WHOM TEACHER INTERACTED:	86%	40%
PERCENT OF INTERACTIONS INITIATED BY STUDENTS:	41%	65%
AVERAGE NUMBER OF INTERACTIONS PER MINUTE:	.80	.44
INCIDENTS OF STUDENT'S WAITING FOR THE TEACHER:	None	None
PERCENT OF EVENTS RELATED TO:		
1. Subject Matter	53%	62%
2. Systems	46%	38%
3. Affective	1%	0%
PERCENT OF TIME INVOLVED IN TRAFFIC CONTROL:	6.3%	8.2%
GIVING GRADES IN CLASS:	None	None
INCIDENTS OF INQUIRING IF STUDENT NEEDS ASSISTANCE:	2 Events	4 Events
INCIDENTS OF DISCIPLINE EVENTS:	16	6
NUMBER OF TEACHER INITIATED EVENTS:	26	15
AVERAGE NUMBER OF EVENTS IN SINGLE STUDENT-TEACHER INTERACTIONS:	2.7	2.4
NUMBER OF TEACHER-WHOLE CLASS INTERACTIONS:	None	None

COMPARISON OF TWO OBSERVATIONS MADE ON TEACHER A ON THE SAME DAY IN LAP CLASSES

Table 4 - 27

Consequently, the situational variables are quite comparable for the two observations. Observation 2 had four more students than Observation 1, but essentially the classes were of the same size.

In spite of the situational similarities between the observations, Table 4-27 reveals that there are many differences between the two classes. In Observation 1, the teacher interacted with 86% of the students, and in Observation 2, he interacted with only 40% of the students. In Observation 1, 41% of these interactions were initiated by the students, and in Observation 2, 65% of the interactions were initiated by the students. This difference suggests that in Observation 2, the teacher, for some reason, did not walk around and talk to the students as he had done in the first observation, but that he waited for the students to contact him.

The possibility exists that the students initiated so many interactions with the teacher that there was no time (or need) for the teacher to initiate interactions. However, the average number of interactions per minute shows that less time was spent on student-teacher interactions in the second class (.44) than in the first class (.80). Also, there were no recorded incidents of students trying to get the teacher's attention and having to wait for the teacher in either class. The level of student-initiated interactions is approximately the same in both classes.

The percent of time taken up by events related to subject matter varied from 53% of the time in Observation 1 to 62% of the time in Observation 2, with systems being the main loser for Observation 2. Thus, in Observation 2, while the teacher had fewer interactions with the students, he apparently was more involved with subject matter concerns. The percent of time involved in traffic control events is slightly higher for Observation 2 than for Observation 1, but both figures are of the same order of magnitude. In neither class did the teacher give grades to the students.

While in both classes there is a very low incident of inquiring if the student needs assistance (1714's), more events occurred in Observation 2 (in which the teacher had initiated fewer interactions) than in Observation 1. Incidents of discipline events were greater in Observation 1 with sixteen events, and only six events in Observation 2. Some of the difference in the number of students with whom the teacher interacted could be due to the different discipline nature of the class.

The number of teacher-initiated events was 26 for Observation 1 and only 15 for Observation 2 which again suggests that the teacher was not as actively involved in Observation 2 as he had been in Observation 1. The average number of events which occurred in single student-teacher interactions was approximately the same in both observations, being only slightly higher for Observation 1. This is additional evidence that it is unlikely that the difference in the number of interactions is a function of the length of the number of interactions. Since the two figures are so similar, however, that possibility cannot be ruled out.

In neither observation were any teacher-whole class interactions recorded. Rather, this particular teacher interacted primarily with single students. In both of these classes, which were back to back, the observer noted in her general comments that the teacher was always rushed throughout the class and that he worked with individual students.

From this brief comparison of two observations taken on the same teacher, it can be seen that important intra-teacher differences do occur. Consequently, when interpreting summary statistics in synthesized tables, it should be kept in mind that even when the tables do not show variation, there probably is variation.

A Comparison of Observations Made on Two LAP Teachers

The preceding section illustrated the presence of intra-teacher differences in different classes. This section deals with inter-teacher differences. Table 4-28 compares Teacher A, for whom two observations were discussed in the preceding section, with Teacher B who teaches in the same general subject matter area. In the case of Teacher A, the averages presented in Table 4-28 are based on the two previously discussed observations plus one additional RO_1 observation. For Teacher B, the averages were based on three RO_1 observations and four RO_2 observations in seven different classes. These particular teachers were picked for comparisons because they are both of the same sex, are both in the same general subject matter area, and because they both teach in LAP situations.

There is a slight difference in the average size of the class, with Teacher B having a few more students than Teacher A. There is a large discrepancy in the average percent of students with whom the teacher interacted. Teacher A interacted with 63% of the students in the class, while Teacher B interacted with only 19% of the students in the class. For both teachers approximately 53% of the interactions were initiated by the students and the average number of interactions per minute is .62 and .65 which indicates that Teacher A was perhaps spending

VARIABLE	TEACHER A	TEACHER B
AVERAGE NUMBER OF STUDENTS:	25	31
AVERAGE PERCENT OF STUDENTS WITH WHOM TEACHER INTERACTED:	63.0	19.2
AVERAGE NUMBER OF INTERACTIONS INITIATED BY STUDENT:	53.0	53.2
AVERAGE NUMBER OF INTERACTIONS PER MINUTE:	.62	.65
AVERAGE NUMBER OF STUDENTS WAITING FOR TEACHER:	None	8.0
AVERAGE PERCENT OF TIME ON EVENTS RELATED TO:		
1) Subject Matter:	57%	40%
2) Systems:	41%	59%
3) Affective:	2%	1%
AVERAGE PERCENT OF TIME IN TRAFFIC CONTROL:	7.2	11.9
AVERAGE FREQUENCY OF INQUIRING IF STUDENT NEEDS ASSISTANCE:	3.0	0.3
AVERAGE FREQUENCY OF DISCIPLINE EVENTS	11.0	1.7
AVERAGE NUMBER OF EVENTS IN SINGLE TEACHER-STUDENT INTERACTIONS:	2.6	2.0
AVERAGE NUMBER OF TEACHER-WHOLE CLASS INTERACTIONS:	None	1.7
VOICED TEACHER POSITION ON: 1) Student Interactions:	Wants to see all the students; feels he can never see enough of them.	Wants students to seek his assistance; feels concerned when they did not ask him questions.
2) Lecturing:	Would like to lecture, but says that the students are too far apart on the LAPS.	Would like to lect- occasionally and has doubts that it is best not to do so.

COMPARISON OF OBSERVATIONS MADE ON
TWO TEACHERS IN LAP SITUATIONS

Table 4 - 28

only a little longer with students than was Teacher B. This same conclusion is indicated by the average number of events in single teacher-student interactions. The average for Teacher A was 2.6, and the average for Teacher B was 2.0.

The average number of students waiting for the teacher was eight for Teacher B but there were no students observed waiting for the teacher in Teacher A's classes. While the average length of the wait is not indicated in the table, the figure includes all waits of longer than fifteen seconds.

Teacher A spends approximately 57% of his time on subject matter related events, while Teacher B spends only 40% of his time on subject matter related events. Consequently, for systems events, Teacher A spends only 41% of his time and Teacher B spends 59% of his time. This is perhaps partially reflected in the difference in percent of time in traffic control events which is 7.2% for Teacher A and 11.9% for Teacher B.

The average frequency of inquiring if students need subject matter assistance reveals additional difference in the two teachers. Teacher A averages 3 such questions per class, while Teacher B averages .3 such events per class. Another category which gives a difference between the two teachers is the frequency of discipline events. Teacher A averages 11.0 discipline events per class, while Teacher B averages only 1.7 discipline events. The average number of teacher-whole class interactions was none for Teacher A, but Teacher B has 1.7 of such interactions for each class.

Included at the bottom of the table are brief summaries of statements each teacher has made on student interactions and lecturing. Teacher A wants to actively seek out and see all the students and he feels that he never has enough time to see enough of them. Teacher B, on the other hand, wants students to seek his assistance and he feels concerned when they do not ask him questions. On one occasion he said, "I find myself wandering around the room trying to look as though I deeply desire someone to ask some questions." These differences in philosophy seem to concur with the observed differences in classroom management reported above. Teacher A, who worries about not being able to see all the students, interacted with 63% of the class. Teacher B, who is concerned because the students are not asking him questions, interacted with only 19% of the class.

On the subject of lecturing, both Teacher A and Teacher B say they would like to lecture at least occasionally. Teacher A says he cannot lecture because the students are too far apart on the LAPs for him to lecture on a topic to all of them. Teacher B doesn't lecture because the system is structured in such a way that lecturing is not encouraged. However, his statements imply that he questions the wisdom of the system for not permitting him to lecture.

Both Teacher A and B are in the same department and are in the same teaching situation (LAPs). They have, therefore, been included in most of the preceding group comparisons as members of the same group, and in the inverse factor analysis, they both loaded on the same factor. Yet, looking at their observations and comparing them to one another reveals several distinct differences in how they manage an individualized LAP classroom. It is important to remember that wide individual differences still occur and that management patterns will vary from teacher to teacher even if the instructional situations are highly similar. Similar comparisons can be made between all of the teachers from which observational data were collected. If such comparisons were made, it would be extremely unlikely that any two teachers would exhibit patterns any more similar than that of Teachers A and B in Table 4-28. Because criterion data on student performance were not collected (see discussion in the chapter on instrumentation), an adequate evaluation of students' achievements in the two teachers' classes cannot be made. It is quite probable, however, that the achievement would be higher in one class than another. Of course, while the subject matter is in the same general area, it is different for the two teachers, and no direct comparisons in achievement can be made.

Summary

The data collected during Phase I have been examined in various ways which isolate many of the classroom role behaviors of the Nova teachers. Being a descriptive study with premises and focuses, but not hypotheses, the analyses in this chapter by no mean exhaust the possible ways in which the data can be studied.

Of particular interest in this chapter has been the identification of those teacher behaviors which are unique to the LAP classroom. As a descriptive, ex post facto study, no definite determination of the causes of any particular teacher characteristic can be made. While possible causation can be discussed, no conclusions about causation can be reached. Not only is the study ex post facto, but the "natural" environment in which the teachers were studied was confounded by many uncontrolled, extraneous sources of variation. Included in the sources of confounding are the effects of subject matter and the effects of the teachers' demographic and personality characteristics.

Despite these limiting considerations, the data provide a good description of LAP classes (as well as other classes) as they existed at the Nova Schools during the observations. There are many behavioral characteristics which differentiate LAP classes from Traditional classes and to a lesser extent, classes which are individualized but do not use LAPs can also be separated from Traditional classes. However, since this has been a descriptive study, the results should not be extended beyond the teachers who were actually studied.

As the result of the data analyses discussed in this chapter, a series of behavioral characteristics of the teachers in the Nova LAP classes can be identified. (Similar lists of characteristics should be prepared for the other three types of teaching situations.) The more salient of these characteristics are included in the following list.

1. LAP teachers spend 62% of their time in subject matter related events, 36% in system related events, and 2% in affective related events.

2. Of the total events in which the LAP teacher engages, only 24% are self-initiated. Of the events which are self-initiated, 40% relate to subject matter, 57% relate to systems, and 2% relate to the affective realm.

3. Eight percent of the LAP teacher's time is spent in traffic control events which averages .28% per student.

4. LAP teachers tend to make few inquiries about students' needs for assistance in subject matter, but they make slightly more inquiries than do their counterparts in the Non-LAP-Individualized classes.

5. Compared to teachers in Traditional classes, LAP teachers spend:

    (a) less time presenting subject matter information to students;

    (b) less time in the management of cognitive activities through the use of noncognitive directions, requests, etc.;

    (c) more time in traffic control;

    (d) more time using various non-instructional materials to aid in the management of students;

    (e) more time getting supplies and materials for students;

(f) more time evaluating students in both subject matter and systems;

(g) more time grading students and discussing grades;

(h) more time in housekeeping chores such as cleaning facilities;

(i) more time giving system directions to students;

(j) more time directing students to do logistical tasks;

(k) more time in events coded as no observable relevant activity;

(l) less time asking questions and selecting students to answer questions;

(m) less time interacting with the whole class; and

(n) about the same amount of time interacting with single students (but the interactions seem to be qualitatively different).

6. Compared to Traditional classes, students in LAP classes:

   (a) initiate many more interactions with the teacher;

   (b) tend to have to wait more for the teacher's attention; and

   (c) tend to interact more among themselves.

7. LAP teachers tend to have similar patterns in the time spent in logistic and maintenance events, but dissimilar patterns in time spent in affective events and reward and punishment events.

8. At least a core group of LAP teachers have patterns of time utilization across events which tend to be directly polar to a core group of Traditional teachers.

These characteristics have varying degrees of evidence to support them. Further, many of these findings are corroborated by casual observation and by teachers' ad lib self-reports. In brief, the portrait presented of the LAP teacher is one of a person who performs many activities which are supportive of the students' cognitive activities, but which are not directly involved with the subject matter. No data in this report can determine definitely if this behavioral pattern is imposed by the LAP or if it is the result of other factors, but a priori considerations strongly suggest the importance of the LAP (see Appendix A).

The students in LAP classes interact frequently among themselves and initiate most of the interactions they have with the teacher. As discussed in Chapter II, no student performance or attitudinal data were collected. Consequently, no statement can be made about the level of performance of students in the LAP classes. Behaviorally, they appear to be less constrained, but it cannot be determined from the data collected whether this is process, product, or both.

Comparisons of two teachers in LAP situations and of two observations on the same teacher in LAP situations illustrate that considerable inter- and intra-teacher differences can exist. General conclusions about LAP teachers can only refer to group averages and overall characteristics. Any particular teacher may vary considerably from the pattern described above.

CHAPTER V

THE PROTOTYPE WORKSHOP ON CONTINGENCY MANAGEMENT

Introduction

This chapter of the report is adapted, in part, from the material presented in Appendix D, on the Contingency Management System as prepared by Westinghouse Learning Corporation. The basic purposes of preparing a workshop course in contingency management, the general definition of contingency management, the objectives of the workshop, and the general procedures of the workshop are presented here. Detailed information, extensive course sequence and instructional materials information, tests, progress checks, and diagnostic devices to be used in the workshop are found in the Appendix.

In the basic plan presented in the proposal (see Chapter I), various prototype training units are to be developed to teach the systems management characteristics of the teacher's role. These are to be developed in the second phase of the project as an outgrowth or product of the system design work also to be done in Phase II.

The basic effort of Phase I has been data gathering and analysis. An attempt has been made in this phase to gather all data which might be useful and not overlook or prejudice efforts of future phases of research. Thus, extensive methods of gathering information were utilized.

Since one major thrust of following phases will be on the use of in-service training methods to change teacher behavior, it was considered useful to make an initial test of the in-service teaching workshop early in Phase II. It is expected that this test will reveal considerable information concerning the potential success of in-service training along dimensions which include the nature of the workshop, the necessary degree of individualization, the amount and type of required simulation exercises for rapid generalization, various media, and testing contingencies for which to prepare, etc. To ascertain this information, a workshop package was developed to provide in-service instruction during Phase II to a sample of Nova teachers in extrinsic classroom motivation through the technology of contingency management and behavioral engineering. This course of study was selected because it might possibly be a component of the teacher training packages to be developed in later phases; but the main purpose for its use is to institute a unique form of teacher training and observe what happens to teachers under the training circumstances. It is assumed that this exercise will reveal system constraints that will have to be taken into account during the later phases of this project and in general provide valuable inputs to our design and development process. Other factors leading to the development of this particular training package are:

1. Westinghouse Learning Corporation had previously prepared a similar workshop in motivation management which had been successfully delivered to a group of twenty-four in-service teachers. Follow-up data on these teachers had been gathered indicating the strengths of the workshop and where specific components of the workshop could be improved.

2. An extensive amount of data has been collected on the technology of contingency management. The system has been implemented in a pre-school program and in a remedial education center encompassing grades one through twelve. In addition, after attending the previously mentioned workshop, teachers in various parts of the United States have successfully implemented the system in their classrooms.

3. It is assumed that a system of motivation management is one of the components of classroom management with which the Nova teachers are not familiar. An opportunity to evaluate the effects of implementing an innovative system will then be available.

Thus, the trial workshop to be implemented in Phase II will be backed by considerable experience in implementation and will provide instruction in an area in which a void currently exists.

What is Contingency Management?

Contingency management is a motivation system based on the principle of learning theory that "for any pair of responses, the more probable one will reinforce the less probable one."[1] Contingency management requires the arrangement of the environment so that the occurrence of more probable

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[1] D. Premack, "Toward Empirical Behavior Laws: I. Positive Reinforcement," Psychological Review, 66, (1959) p. 219.

responses (reinforcers) are dependent upon (contingent upon) the execution of certain less probable responses (such as the completion of a learning activity package or a laboratory experiment in the classroom). Contingency management is a highly useful form of extrinsic motivation. As a procedure it provides for a reinforcing consequential activity contingent upon some learning behavior on the part of the student.

Motivation is the causative factor, instigator or inducer of action. It is often loosely termed the energizer of behavior. Individuals are considered to be motivated to eat, to sleep, to make money, to be famous, etc. Klineberg[2] proposed four groups of motives based on their dependability and the degree to which they are assumed to have an internal physiological basis. Maslow[3] presented a hierarchy of motives ranging from basic physiological needs to actualization of fulfillment needs.

Closely allied to the concept of motivation is that of reinforcement. The conditions following a behavior or a set of behaviors (responses) which make that behavior (or behaviors) more likely to occur again in the future are termed reinforcement. For the classroom teacher, reinforcement can generally be thought of as being almost synonomous with the term reward, but important distinctions occur between the terms.* A well known and well-developed approach to the subject of reinforcement and its relationship to motivation is Hull's[4] drive construct approach. In this frame of reference, reinforcement is explained in terms of drive reduction where reinforcement is said to reduce drive stimuli, to satisfy an internal need which in turn strengthens the responses which lead to drive reduction. Although this explanation has been widely applied, drive constructs appear to have little value in handling the practical problems of motivation in the classroom.

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[2] O. Klineberg, Social Psychology (revised edition; New York: Holt, Rinehart & Winston, 1954).

[3] A. H. Maslow, Motivation and Personality (New York: Harper & Bros., 1954).

*The principle distinction is that reward is assumed to be pleasurable while reinforcement can be pleasurable, neutral, or even painful since it only indicates the increased probability of the occurrence of the event it follows.

[4] C. L. Hull, Principles of Behavior (New York: Appleton-Century-Crofts, 1943), and Essentials of Behavior (New Haven: Yale University Press, 1951).

In the application of the concept of motivation to the classroom it is usually assumed that all students can be induced, aroused or "energized" toward certain activities and that some optimal arousal level exists for facilitating learning. Some of these energizers, the ones thought of by Klineberg and Maslow as being physiologically based, are thought of as being a part of or built into the student. Also, as a result of experiences in his life, the student seems to develop other internal states or conditions, many of which are apparently socially based such as a need for peer or adult approval. Motivation is of primary importance in learning or, at least, in the performance of activities involved in learning.

Motivation can be assumed to generate either primarily from within the individual or from outside of the individual. The issue of whether motivation is "inside" and basically the responsibility of the student or is subject to considerable "outside" influence and can be extracted, aroused, or facilitated by the teacher is important in approaches to teaching methods. The general approach to motivation used to emphasize the generation from inside with a presumed natural state of high motivation which could be damaged by external attempts at influence. Recent trends have been toward an approach to motivation as subject to external stimulation, an outgrowth of empirical research particularly in the area of operant conditioning.

The approach of an education system and the personnel within it to motivation has a distinct effect on the teacher's role. If the reinforcement or external stimulation position is adopted, an important function of the teacher is to arrange circumstances to arouse the motivation of the student. This would require that teaching methods be modified to allow the teacher to supply adequate reinforcement for the student. In the past relatively little has been known about what motivates students, particularly since childrens' backgrounds may vary widely.

In an important series of papers beginning in 1959, Premack[5] has said and found evidence in support that there is no need to invoke a drive concept in explaining why water (for

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[5]D. Premack, op. cit.; "Predicting Instrumental Performance from the Independent Rate of the Contingent Response," Journal of Experimental Psychology, 61, (1961), 163-171; "Rate Differential Reinforcement in Moulay Manipulation," Journal of Experimental Analysis Behavior, 6, (1963), 81-89; "Prediction of the Comparative Reinforcement Values of Running and Drinking," Science, 139, (1963), 1062-1063; "Running as Both a Positive and Negative Reinforcer," Science, 142, (1963), 1087-1088; "Reinforcement Theory," Nebraska Symposium on Motivation 1965, ed. D. Levine (Lincoln: University of Nebraska Press, 1965).

example) functions as a reinforcer. If water functions as a reinforcer, it does so simply because the experimenter has arranged matters (by deprivation) so that drinking has a higher probability than the response the experimenter wishes to be strengthened. As further support for this formulation he has shown that, under appropriate conditions, drinking can be reinforced by the opportunity to run. In Premack's experiments, it is the reinforcing response that is emphasized, not the reinforcing stimulus. Extending this conceptualization, it may be possible to predispose a human subject so that, momentarily at least, a given behavior is at a higher probability than the one we are attempting to strengthen. In a series of papers beginning in 1963, Homme and others[6] have explored the discussions of Premack's differential probability hypothesis and have formulated a system which is called the contingency management motivation system.

Contingency management is but one type of motivation management. It is a procedure which provides some reinforcing consequential activity contingent on some appropriate behavior of an individual to provide motivation in a learning environment. It is a system emphasizing external arrangements for motivation. To do this in the classroom the following must be done:

1. Events which are positive consequences must be identified.

2. These events must be made available to the individual.

3. A decision allowing the individual to engage in these events must be made.

4. The criterion on which these decisions are based must be determined.

5. The behavior of the individual must be evaluated.

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[6]L. E. Homme, P. C'deBaca, J. V. Devine, R. Steinhorst, and E. J. Rickert, "Use of the Premack Principle in Controlling the Behavior of Nursery School Children" Journal of Experimental Analysis of Behavior, 4, (1963), p. 544; L. E. Homme, "A Demonstration of the Use of Self-Instructional and Other Teaching Techniques for Remedial Instruction of Low-Achieving Adolescents in Reading and Mathematics" (U. S. Office of Education, Contract No. OE-4-16-033, 1964); L. E. Homme and D. T. Tosti, "Contingency Management and Motivation," NSPI Journal, Vol. IV, No. 7, (1965); L. E. Homme, "System for Teaching English Literacy to Pre-School Indian Children," final report. (Submitted to U. S. Department of Interior, Contract No. 14-20-065001506, October, 1965.)

These activities or requirements can be arranged in almost any setting. The laboratory psychologist arranges for positive consequences (No. 1, above) by depriving the rat of water. He arranges to make events (water) available to the rat (No. 2) in a device. He makes a decision (No. 3) allowing the rat to engage in the event (drinking water) on the basis of whether or not the rat presses the bar (No. 4) and then he evaluates (No. 5) the rat's behavior by observing the rat and recording its responses. (Some of the above activities may be partially or completely automated by the apparatus involved.) The same general sequence occurs when the teacher discriminates reinforcing events and makes them available to the student when he has successfully passed a unit test.*

To keep the student in the learning environment or to keep him responding at a normal rate, his learning activity must lead to some preferred consequence, i.e., a higher probability response. Laboratory studies of reinforcement typically use the preferred consequences of eating or drinking to motivate animal behavior. Equivalent kinds of reinforcement can be used with children. However, it is usually awkward to use this kind of reward for learning activities in the classroom. It is difficult and undesirable to starve humans or to place candy in their mouths for correct responses. This creates an almost impossible position if laboratory studies are to be extrapolated—rewarding consequences are necessary but impractical. Thus, the importance of Premack's principle becomes apparent in the classroom because it does not limit reinforcing events to satisfying physiological need states which have been created by deprivation. Rather, any high probability response can become a reinforcing event for a lower probability response. The mechanics of contingency management and the employment of Premack's principle are discussed later in this chapter.

Those who will object to the conceptually simple treatment of behavior and reinforcement presented here may argue that human motivation is a highly complex affair, involving much more than the simple matter of the consequences that behaviors produce. This is generally the position taken by the advocates of an internal emphasis for motivation which may be a valid premise. It surely is not a sound reason for ignoring the simple facts of life. Acceptance of the fact that human motivation is affected by individual emotions, ideas, hates, and loves should not rule out also accepting the importance of the consequences of behavior. Regardless of

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*There is no comparison between rats and children intended here. The intention is to show a procedure or sequence that can be applied under appropriate circumstances to either.

the existence or nonexistence of internal constructs associated with motivation (or other behavior), the effects of the occurrence of reinforcing events can be observed and documented. Contingency management can be used to strengthen specific responses in the classroom; whether or not it satisfactorily explains internal states is functionally unimportant.

Individualization and Motivation

The procedures designed to provide positive consequences for performance according to established criteria are more favorably adapted to individualized instruction than to group instruction. As pointed out in earlier sections of this report, individualized instruction consists of planning and conducting with each student a program of studies that is specifically tailored to his learning needs and his characteristics as a learner. It also requires that the basis for decision making and planning be the behavior of the individual student.

Although the presence of large groups in instruction usually inhibits the individualization of instruction, this fact is not in itself the defining attribute. Hence, even in a conventional classroom, when the teacher stops and modifies his presentation as a function of a student's query, that student is given a partial, though probably inadequate, form of individualized instruction. It is conceivable that in an individualized instructional setting, after assessment of students' repertoires, it can be decided that fifty students require a given film or a given lecture. Although all fifty students will receive the information simultaneously, they will still be within an individualized environment. (Of course, it is probably unusual for fifty students to need the same thing at the same time.)

The degree of individualization can best be thought of as a function of the frequency of personal assessment of each student relative to his need for assessment and the frequency at which his educational program is modified according to his needs as revealed by the assessment. Assessment and modification of each student's program at as frequent intervals as required to optimize the student's learning experiences is the goal for an individualized program. This is important here because the management of individual contingencies follows precisely the same formal procedures as does instructional presentation management, i.e., appraisal of each attribute of the student's behavior, decision to select or assign some alternate activity, and the student's exposure or engagement in that activity.

Although the principles of contingency management can be communicated on a verbal and practical level at the completion of a workshop, the success of its use in classroom situations depends on the degree of individualization of instruction which can be incorporated into those classrooms. This implies that the maximum benefits of the contingency-managed techniques and procedures can be realized in classrooms which are highly individualized, such as those in experimental project areas like the Individually Prescribed Instruction (IPI) Schools, the Nova Educational Complex Schools, and Project PLAN Schools.

The basic manner of managing contingencies in human learning has been through verbal or written contingency contracts. As one might suppose, the general contract—"do some amount of lower probability behavior, then you may do some higher probability behavior"—can take a variety of forms. It may be formal or informal, explicit or implicit, or some combination of these. But, whatever its form, contracting will work if some basic rules are followed. These are simply to require an extremely small amount of lower probability behavior before the higher probability behavior is permitted to occur and to settle for approximations early in the game. As experience is gained in contingency contracting, the amount of task or low probability behavior demanded is gradually increased until it is a sizable amount; but it should be emphasized that, during the early phases of the student's learning about contracting, the demands on the student be kept small and the payoffs prompt.

Behavioral Engineering

In general terms behavioral engineering can be thought of as arranging the conditions of the environment to achieve the performance of a desired behavior. It is the application of laws of behavior to everyday problems.[7] The basic paradigm of stimulus-response-reinforcement can be used to define behavioral engineering because it is derived from the laboratory science of operant conditioning. The first two units of this paradigm, stimulus-response, are involved in the establishment of stimulus control—the arrangement of the environment so that the appropriate response is under the control of the discriminative stimulus. When the student responds "eight" to the stimulus "what is two times four?" proper stimulus control has been demonstrated.

The second and third units, response-reinforcement, are involved in behavior frequency control. The number of times a response occurs tends to be a function of the reinforcement schedules bearing upon the response. The contingency management system focuses on behavior frequency.

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[7] L. E. Homme, P. C'deBaca, L. Cottingham, and A. Homme, "What Behavioral Engineering Is." (Albuquerque: Westinghouse Learning Corporation, 1968.) (Mimeographed.)

Behavioral engineering is the application of stimulus control and behavior frequency control. The Workshop on Contingency Management includes an introduction to the principles of stimulus control in an effort to sensitize the teacher to the importance of stimulus control and its relation to contingency management.

Informal Contingency Contracts

A family of five, consisting of the two parents and three children ranging in age from two to seven, are seated at the dinner table. Dinner is served and everyone begins to eat, but the youngest child refuses to eat his peas. He concentrates instead on his hamburger. Here we have a clear-cut case of two behaviors differing in likelihood of occurrence. Eating peas is obviously a low probability behavior. Eating hamburger is a higher probability behavior. The knowing contingency manager, then, formulates the contract, "Eat one bite of peas, then you may have some more hamburger."

In the foregoing case, the contingency manager simply noticed what was the high probability behavior of the moment and made that contingent on executing some behavior the contingency manager wanted. What happens if there is no behavior occurring? Under unusual circumstances, this may even happen to an experienced contingency manager. This appeared to be the case with a psychotic, 16-year-old blind girl who had been hospitalized for eight years. When seen, she was staring mutely at the wall, apparently doing nothing. The contingency manager walked over to her and said, "Hello." Immediately the girl reached out, grabbed his hand, and smelled the back of it. She had revealed a high probability behavior for the contingency manager with this one gesture. Within a few minutes, the contingency manager had her talking at a great rate (more than she had ever talked in the hospital) by making the smelling of his hand contingent on her talking to him.[8] There is no problem in getting behavior one wants emitted if one is willing to arrange a payoff for an approximation to it at first.

The Formal Contingency Contract

The Contingency Contract is based upon the Premack principle of discriminating the low probability (nonpreferred) response from the high probability (preferred) response and increasing the role of the low probability response. In laymen's terms, the appropriate act is rewarded and is more likely to recur if the reward is sufficient. The traditional education system is generally time contingent, i.e., the student or pupil attends class or classes for a certain time period or reads and does math for so many minutes or hours and then goes home, or to P. E. class, or participates in a group discussion.

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[8]L. E. Homme and P. C'deBaca, "Contingency Management on the Psychiatric Ward." Unpublished manuscript, 1965.

The reward, or reinforcement, is not contingent on a certain task being completed or a specific level of performance being achieved but rather on whether the pupil sat in a certain place for a certain amount of time. Also in the traditional school classroom, progress checks, unit tests, or some other form of evaluation device to specify what increase or decrease in rate of learning has occurred are not generally available. In the individualized instructional classroom, these progress checks are fundamental to the system and readily available.

When the contingency contract system is implemented in the structured educational environment, the student gets reinforced for performing a task he may not like to do. For example, a student may enjoy reading but dislike math. To reinforce math he would first work several problems and then read a story. If reading is of higher probability than math, the math responses (i.e., math learning) will increase, since these are the responses that are reinforced. The contract is simply a statement of the order in which low probability behaviors and high probability behaviors occur during the student's education tenure.

As mentioned above, this system is more easily adapted by a school which has an individualized instruction program. The Nova Schools are individualized to a significant degree with individualized materials and testing or progress checking devices and offer a good opportunity to test the implementation of the contingency management motivation system.

The Workshop Objectives

The Workshop for the Contingency Management System has been carefully designed to achieve extensive objectives in five areas. These areas are:

I. Principles of Behavioral Engineering.

II. The Theory of Contingency Management Motivation.

III. Applied Contingency Management.

IV. Philosophy of Learning.

V. Implementation Design.

It is assumed that complete mastery of these five areas will allow the teacher to successfully implement the contingency management system in the classroom. The objectives also will give the teacher extensive sensitivity to and skills in principles of individualized instruction and behavior modification. The Workshop is designed to run for eight hours per day for three weeks. A thorough listing of the objectives follows.

Objective I. Principles of
Behavioral Engineering

Given the components of learning and reinforcement theory as these apply to behavioral engineering, the student will be able to recognize definitions of the relevant terminology and recognize and describe applications of the principles involved. The following enabling objectives will be met:

1. Given a list of terms and multiple choice definitions, the student will be able to choose the correct definitions for each term.

2. Given components of behavioral engineering and multiple choice descriptions of the effects of the components on behavior, the student will be able to choose the correct effect.

3. Given descriptions of isolated human behaviors, or behaviors in the context of a group and the components listed in objective 2 above, the student will be able to describe when the principles of behavior were correctly applied, incorrectly applied, and what changes should be made to correctly apply behavioral principles.

Objective II. The Theory of
Contingency Management Motivation

Given the specific components of a contingency managed classroom, the student will be able to list these and describe the use, effects, and interaction of these components on the behavior of students in a classroom.

1. The student will be able to define and describe the Premack Principle in terms of:

   a. reinforcing responses and reinforcing stimuli, and

   b. high probability behaviors versus low probability behaviors.

2. The student will be able to describe and give examples of reinforcing events in terms of:

   a. reinforcing stimuli,

   b. reinforcing responses,

   c. reinforcing event menu, and

   d. reinforcing event area.

3. The student will be able to define and describe the rules of contingency contracts in terms of:

   a. immediate reward,

   b. reward of small approximations,

   c. reward frequently with small amounts,

   d. reward accomplishment rather than obedience,

   e. reward performance after it occurs,

   f. fairness of contract,

   g. clearness of contract,

   h. honesty of contract,

   i. positiveness of contract, and

   j. systematic use of contract.

4. The student will be able to apply the rules of contracting in criticizing hypothetical situations in which:

   a. reward is delayed over a period of time,

   b. a large amount of hard task is followed by small reinforcement,

   c. a large amount of an easy task is followed by large reinforcement,

   d. a large amount of an easy task is followed by a small reinforcement, and

   e. reward procedes the task.

5. The student will be able to describe the types of contracts in terms of:

   a. manager-controlled contracts,

   b. student-controlled contracts, and

   c. transitional contracts.

6. The student will be able to describe the instructional sequence in terms of:

a. task identification (behavioral objectives),

b. selection of materials to correlate with the tasks,

c. diagnosis of individual student level by means of:

<u>1</u> prescriptive tests,

<u>2</u> progress checks,

<u>3</u> unit tests.

d. a task area.

Objective III. Applied
<u>Contingency Management</u>

Given the ability to define and describe the components of learning and reinforcement theory and the components of a contingency managed classroom, the student will be able to apply both in establishing and operating a contingency managed classroom according to the following:

1. Select a specific subject matter area and:

   a. identify the major tasks that constitute the curriculum (construct behavioral objectives),

   b. specify material appropriate to the tasks,

   c. divide the curriculum into task units,

   d. specify appropriate tasks,

   e. provide a task area,

   f. provide a reinforcing event area,

   g. identify existing, feasible, and useful reinforcing events,

   h. design methods of controlling available reinforcing events, and

   i. determine time to be allotted for reinforcing events.

2. Measure student progress by:

   a. establishing the criteria for determining progress, and

   b. providing diagnostic tests, progress checks, and unit post tests.

3. Do the following when the students arrive in the classroom:

   a. orient them to the contingency management system,

   b. give a prescriptive t st,

   c. specify students' entry level on a diagnostic profile,

   d. establish contracts with the students,

   e. reinforce appropriate oral responses and behaviors,

   f. extinguish inappropriate behaviors and extinguish incorrect oral responses,

   g. shape students behaviors by reinforcing successive approximations to the terminal response, and

   h. recognize and remedy contract malfunctions.

Objective IV. Philosophy of Learning

Given a list of objectives to the contingency management system, the student will be able to defend the system by applying the principles of learning and reinforcement theory. The student will be able to:

1. Explain why and how extrinsic reinforcement is a means of developing and maintaining intrinsic motivation.

2. Explain why a reinforcing event menu may be a helpful device.

3. Describe how an individualized instructional system benefits student progress.

4. Describe how punishment may increase the probability of an undesired student response.

5. Desc·ibe how an effective contingency management syst·m can positively effect student learning rate.

6. Describe how frequent progress check benefits both the teacher and the student.

7. Describe why approximations to the correct response should be reinforced rather than only reinforcing the ıinal correct response.

8. Given the statement that the contingency managed classroom is a synthetic or mechanistic environment, (a) support the statement, and (b) refute the statement.

9. Describe why the contingency managed classroom is not a form of immoral control of human behavior.

10. Describe how the contingency managed classroom provides the teacher with more opportunity to become (a) a guidance specialist, (b) a more positive role model for her students, and (c) more sensitive to individual student needs.

11. Given examples of student behaviors where academic activities are preferred to nonacademic activities, describe various contracts which can be made, depending on the specific teacher objectives.

12. Given examples of classrooms where the time constraints are such that it is difficult to implement the contingency management system, describe alternatives that would enable the system to be partially implemented.

13. Given an example of a student who shifts from one learning task to another before completing any one task, describe how the contingency management system can be used either to adapt to the student's behavior or change the student's behavior.

14. Describe how undesirable behaviors can be eliminated even when the cause of the behavior is unknown.

Objective V. Implementation
<u>Design</u>

Given mastery of the cognitive and practice in the application of reinforcement and learning principles and the contingency management system, the student will have developed an implementation plan for a motivationally sound instructional classroom. The student will be able to:

1. Critique a written description of how he currently manages his own classroom in terms of previously learned theory.

2. Critique a description of the ideal model in terms of practicality for use in his own classroom environment.

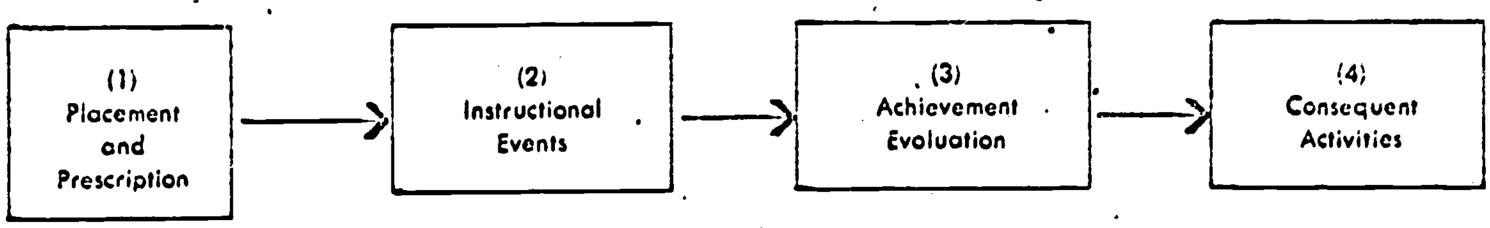
3. Critique a written description of how others have adapted the system in terms of theory.

4. Describe how he will implement the contingency management system in his own classroom.

5. Critique these in terms of theory and practicality.

The Instructional Process for the Workshop

Research into classroom management and instructional materials has led Westinghouse Learning Corporation to formulate a generalized four-part model for the classroom. This process will be followed in the workshop.[9]



THE PRIME MODEL

Figure 4-1

Components 1 and 3 are derived in part from the application of the technology of repertoire assessment developed in the testing and guidance fields.

Component 2 is concerned with the technology of presentation, an area to which people in programmed instruction have contributed much information.

Component 4 can be considered an application of the technology of motivation, which has been primarily identified with the contingency management system.

Although the first three components have been employed by several educational systems researchers in the design of their classrooms, there has been little effort to specify the relationships among them.

This breakdown of components may not exhaust all possible important factors. Specification of any of these additional factors requires further experimental analysis. Although the research is slight, there has been enough conducted to make it possible to describe many of the gross characteristics of these components and describe the methods that have been employed.

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[9] D. T. Tosti, "PRIME—A General Model for Instructional Systems," NSPI Journal. Vol. VII, No. 2. (February, 1968.)

The first level is cognitive acquisition. The workshop participants will be assigned reading materials, self-instructional materials, films, etc., which will describe the basic principles of behavior engineering and contingency management. During this period the participants will also see a contingency managed classroom in operation.

The second level moves from the strictly cognitive area into opportunities for the student to begin applying, in artificial or quasi-realistic settings, the principles which he has learned. In structured role-playing situations, group exercises and partial exposure to the classroom, the student will practice behavior engineering and contingency managing responses.

The third level moves the student into the operation of an actual class according to the principles which he has learned. Although this exposure is relatively brief, it is designed to give the participant a large number of opportunities to practice the appropriate responses.

The fourth level of simulation is one which permeates the entire workshop. Building on the principle that teachers teach <u>as they have been taught</u>, the workshop is an individualized classroom operating according to principles of contingency management.

Participants will be required to take a prescriptive examination and to arrange contracts in accordance with the results of that examination. An opportunity to engage in reinforcing events will be provided upon the successful completion of each contracted instructional segment.

<u>Achievement Evaluation</u>

This individualized instructional system provides for achievement feedback control. The presence of frequent achievement assessment tends to control the learner's behavior by the knowledge that he soon will be tested on what he is studying.

Many of the materials in this workshop contain progress check tests. The progress check is a short test covering a small segment of material. It is not only used for control purposes but has definite motivational properties. In the contingency management system, progress checks are employed as indicators of task completion, signaling to the learner that he now may engage in some preferred activity.

Placement and Prescription

The primary objective of the prescriptive process (in general and for this workshop) is to direct the learner through those materials necessary for him to achieve the desired objectives. The prescriptive method usually involves initial assessment and differential assignment. The initial assessment attempts to list existing characteristics of the learner which will be useful in determining future assignments. The most common characteristic examined is present achievement level, which is the primary assessment in the workshop. Prescription allows the teacher to assign certain instructional units, exercises, or supplementary activities to the learner based on his pre-test achievement results, and the teacher's knowledge of the materials, and the learner's past performance. The resulting assignment will include only those skills which the student requires.

The prescriptive tests used in the workshop will take the form of pre-tests and post-tests. The pre-test is used to ascertain the existing skill areas of the learner or any other behavior which may facilitate the acquisition of new skills. These initial measurements indicate an appropriate starting point and also aid in future assignments by identifying areas of strength or weakness.

The primary difference between prescriptive tests and other evaluation devices is that these tests are used to make curriculum decisions. They are not used for learner control or for grading purposes. The control function is handled by the progress check (see achievement evaluation).

Instructional Events

The decision as to which subjects will be presented in individualized form and which by group instruction is dependent in part on whether good individualized material is available, the cost of preparing or purchasing such materials compared with present efficiency, and the occasional need for the teacher to assume the lecture role.

Individualized instructional materials have been prepared for this workshop, and conventional materials have been modified for individual use. Occasional lectures are required.

For this workshop extensive attention has been paid to the problem of generalization or transfer of training. To insure that the students (the in-service teachers) are able to utilize the skills they are taught in actual classroom experience, the course is organized around four levels of transfer based on the degree to which they simulate the actual classroom.

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Consequent Activities

The establishment of sound, lasting motivation is at once the most important and the most difficult step in building and applying an effective system of instruction. The initial interest intrinsic in most educational programs often wanes after the first few hours of instruction. Full attainment of the learning objectives designed into any given self-instructional program is very difficult unless proper motivation is provided.

Motivation is of utmost importance in all areas of education. No matter how well-conceived, organized, and behaviorally sound a presentation may be, students will learn nothing from it unless they attend and respond. Yet, until recently, there existed no formal method of reliably producing learner motivation.

Since the main purpose of this workshop is to teach the participants the principles of the contingency management motivation system and principles of behavioral engineering, these principles will be used in the workshop. (See discussion of the fourth level of simulation, above, Page .) The reinforcing events which will be required by the participants will differ from those which they will use for their students but only in detail and not in principle.

Procedural Note

To successfully operate the workshop as it is designed, it will be necessary to have available an operating contingency managed class. This class should be established as a remedial program in mathematics. Fifteen students should be selected from the elementary school level and fifteen from the high school level. The class should be operated by two trained members of the Westinghouse Learning Corporation staff, and should begin operation one week prior to the opening of the workshop. It will end at the same time as the workshop. (For a list of materials to be used in the class, see Appendix D.)

Summary

This chapter has discussed the principles of the contingency management system of motivation and how they can be used in the individualized instruction classroom. It has also outlined the objectives and instructional processes for the operation of a workshop in contingency management. Further details on this workshop may be found in Appendix D, the full report on the Motivation Management Workshop.

CHAPTER VI

THE FEASIBILITY OF SIMULATING THE TEACHER'S ROLE MODEL

Introduction

During the extensive planning for the subsequent phases of the Teachers Role Project, it was decided that computerized techniques of classroom simulation should be investigated as a possible fruitful parallel effort to the systems design and prototype training units development efforts (see Figure 1-1, Page 12). Should efforts at simulation of the teacher's role be successful, many aspects of the model can be initially validated and the development of the training programs can be instituted more quickly and at less cost.

Therefore, a preliminary investigation of the feasibility of simulating all or part of the aspects of the teacher's role model was undertaken by personnel at both Westinghouse Learning Corporation and Nova University. This brief chapter is the outcome of those preliminary investigations.

The purpose of this chapter is to indicate some of the general conceptual lines which might be followed in establishing a simulation capability for the analysis of the teacher's role. The handling of the topic of simulation will be limited to overall simulation concepts as they might apply to the specific problem of simulating the teacher's role. There is no intention to make new contributions to simulation theory or technology, to review the current progress of educational simulation, nor to defend or attack specific approaches to simulation. For an admirable introduction to simulation in general, the reader is suggested to consult <u>Computer Modeling and Simulation</u> by Francis Martin.[1] For specific applications of simulation in education see <u>Simulation Models for Education</u> (Fattu and Elam).[1] General and specific articles of interest to the

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[1]In preparation of this chapter, an extensive bibliography on simulation has been compiled and reviewed. This bibliography is presented at the end of this chapter. The reader can refer to this bibliography for full citation of the books

reader wishing a more extensive review of the subject may be found in the bibliography.

Simulation: The Model and the Product

As stated in the first chapter, this project has assumed the position that "instruction is a process that can be approached in a systematic or technological manner, in which the numerous parameters relevant to the efficiency of instruction can be identified, analyzed, and manipulated toward the end of prescribing optimum conditions for learning."[2] One way in which the parameters can be manipulated (after identification) is by simulating the instructional process and varying the values of the parameters. Hence, the computer can perhaps expedite the movement toward prescribing optimum learning conditions.

The data gathering and analysis activities which have been performed in this project have focused on the functions which are performed in the individualized instruction classroom. Early in the next phase, the functions which must be performed in the individualized classroom will be identified. From an analysis of the various ways in which these vital functions can be performed, it is believed that an adequate model (or models) of the teacher's role in the classroom can be developed. (This will be a primary output of Phase II.) It appears that the study of the various behavioral patterns which can be utilized to perform these classroom functions is amenable to computer simulation. Many alternative patterns might be modeled and it may be possible to find levels of optimality in the patterns.

The nature of a model is well described by Flothow: "If one could list every significant function performed by a machine, or by an abstract organism, such as a business organization or a school system, he would have created a model of the original. A model is a simplified, stylized representation of the real world, which abstracts the cause and effect

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by Martin and by Fattu and Elam. Specific textual references are cited in footnotes as has been the practice throughout this report. The footnoted references (which directly concern simulation) are also included in the bibliography for the reader's convenience.

[2]Eldon J. Ullmer, "The Meaning of Instructional Technology: An Operational Analysis," Educational Technology. (December 15, 1968.)

relationships essential to the question it studies."[3] In the second phase of this project, it is planned to develop such a representation of the teacher's role behaviors, with emphasis on the management characteristics, at some optimum level and then simulate the effectiveness of that model under varying classroom conditions. An attempt will be made to put a large number of propositions into a realistic predictive model, manipulate the model to study what effects are produced by the distribution of activities, functions, and the constraints imposed by various circumstances in the model and by the nature of the interaction of the people (teachers, students, administrators) within the model. The general expectation is that this simulation will provide useful information about how the variables collectively interact (within the assumptions of the model) and effect student performance so that this information can lead to useful predictions. In this fashion, the simulated aspects of the model can be tested and validated against criterion variables.

It is hoped that a primary product of the simulation effort will be data that will suggest manageable ways to divide and perhaps reallocate the teacher's functions by providing the basis for breaking down the complicated teacher system and for making suggestions for pooling the many skills and information of the teacher system. Further, it is hoped that the simulation will indicate the more important variables of the system in terms of their particular outputs, how they are related, and how they may be synthesized to provide solutions for specific problems. Emphasis is again placed on the analysis of the functions performed in the individualized instruction environment because many of the functions could possibly be performed by personnel other than the teacher, such as aides, the students, etc. The analysis and simulation would be incomplete if it focused only upon the teacher.

Another expected product of the simulation effort is that through the identification of the more important aspects of the teacher role model, improved decisions can be made regarding the areas in which training programs are the most necessary. While certain decisions can and will be made in the absence of a simulation of the model, the simulation could pinpoint the crucial areas (in relation to specified criterion variables) which are essential to the success of individualized classrooms. The behaviors required for the execution of these crucial areas could then be particularly singled out for attention in the training programs to be developed.

A less important, but interesting, product of developing a simulation program for the teacher's role model is that the

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[3] Rudolph C. Flothow, "Systems Analysis and School Functions," Journal of Secondary Education, XLII. (October, 1967), p. 245.

capability would then exist to test the model on various schools without disrupting existing programs. The degree to which basic changes would be required in the structure (both physical and organizational) of another school for adaptation of the model could be specified by a simulation using as parameters the relevant characteristics of the other schools. A by-product of such an effort would be the identification of the characteristics of the school in which the model could most readily be adapted.

Instructional Simulation Considerations

There has been little research in classroom simulation. Perhaps it is practical to discuss undertaking classroom simulation at the present time only because the concern is with a particular, limited problem—that of the teacher's classroom role—for which data have now been collected and for which models are being contemplated. Without such a limited approach, the simulation of the complex human interaction taking place in a classroom is not feasible and perhaps not possible at the present time.

The most difficult problem confronting a classroom simulation effort is the necessity to strike a balance between the level of behavioral detail that must be simulated to validate the model and the level of detail which it is economically feasible to simulate. A prime example of an attempt to control details (and also the best example known by the authors for simulating the classroom) is the development of EDSIM by Cogswell, et al.,[4] at Systems Development Corporation. A thorough effort was made to provide both detailed recording of events and meaningful summarization of the events.

A procedure for developing a reasonable simulation model has been offered by Sasser and Naylor.[5] The nine steps in Sasser's procedure are:

1. Formulation (definition) of the problem.

2. Collection and processing of real-world data.

3. Formulation of a mathematical model.

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[4]John Cogswell, J. E. Bratten, R. E. Egbert, D. P. Estavan, D. G. Marsh, and F. A. Yett, Analysis of Instructional Systems, TM-1493. (Santa Monica: Systems Development Corporation, 1966.)

[5]W. E. Sasser and T. H. Naylor, "Computer Simulation of Economic Systems—An Example Model," Simulation. Vol. VIII, No. 1. (January, 1967), pp. 21-31.

4. Estimation of the parameters of the operating charateristics of the model.

5. Evaluation of the model and parameter estimates.

6. Formulation of a computer program.

7. Validation of the model.

8. Experimental design.

9. Analysis of simulated data.

The general basis of the simulation suggested for the analysis of the teacher's role is structured around the functions and activities occurring in the instructional process. Included are environmental resources, established procedures for individualized instruction, and student characteristics of rate of learning (slow, medium, fast). It is assumed that the majority of the instructional events to be considered concern interaction patterns of individual students with the teacher, materials, tests, etc., and that these interactions take time. Consequently, it can be assumed that available teacher-time to solve all problems and available student-time spent in profitable study are two parameters of interest.

For an event simulation for the teacher's role, Sasser and Naylor's Step No. 3 should be broadened to include procedural and logical details which cannot be formulated as closed-form mathematical statements. In this case, Step No. 3 could be stated: Formulation of an operational model. The operational model may have statistical and mathematical components as well as procedural and resource components.

Looking at Sasser and Naylor's procedure, Steps No. 1 and 3 are of primary interest in this paper. These steps, formulation of the problem and formulation of the operational model, will be discussed extensively in the following pages.

Specifications for Simulation

The problem of the project is to find an effective teacher role model for an individualized instruction classroom and train the teacher to play this role. To find this effective role it will be appropriate to examine the entire instructional process to find the various patterns of interaction of functions within the process and, from an analysis of these interactions, develop performance specifications for various functional units that can, under predetermined circumstances, be adopted by the teacher. The product of the simulation effort would then be stated in terms of the number of various functional allocations which have been studied by the simulation.

An important consideration for the development of the model and simulation is to make statements concerning the output of the model. These goals or outputs must be measurable, at least on a relative scale, and there must exist a reasonable belief that they can be validated.

When the goals of the teaching system are defined by a set of objectives or value functions, these will be the system outputs, and each possible system input must be weighed for its effect on the system output.

A side effect of not having clearly-stated and measurable objectives for output is that the amount of simulated detail can proceed to microscopic behavioral levels if unchecked for relevancy to the value function outputs. Behavioral details should be included or ignored in the model, depending on an estimation of whether they contribute to the ability to predict the behavior of the output variables of the simulated system.

If, for example, an objective of the simulated classroom is concerned with the time a student spends at his seat without communicating with anyone, then details of possible student learning curves are irrelevant, and the real concern is in exact timing of interactions. If another objective is defined as a measurement of the frequencies of student-teacher interaction, then the simulated level of a student-peer interaction can be quite low or even hidden in the time estimate of a student-teacher interaction. Therefore, the objectives assigned to the problem will greatly affect the level of simulated detail and the structuring of that detail.

Goals and objectives should be specific. It is not sufficient to suggest goals at the simulation level, such as, "How does a particular teacher's role affect the learning behavior of the student?" With such poorly stated requirements, a simulation of much student and teacher behavior can be performed, and an event-time list printed. A researcher can then look over the data and subjectively say, "This role is better than the last." But, still unanswered are: Better in what way? Can the results be iterated for still better results? What about the question of validation? A loose specification of simulation output can produce neither effective simulation nor contribute to correcting the present confused state of the art of teaching.

What are the concrete objectives that can be specified and measured in an individualized classroom situation? This question must be the starting point of problem formulation. For this project, the nature of the goal problem is indicated in the assumptions stated in the introduction of this report. For example, accepting assumption number four that student performance can in part be predicted on the basis of teacher's adequate performance of the management characteristics of the role, the primary system output or criterion variables should relate to specific operational measurements of achievement. Then relations between specific teacher-managerial input variables must be postulated from theory or empirical evidence in such a way that the achievement variables can be predicted from the managerial inputs. In general, at the present state of knowledge, the postulated relationships would likely be mathematically modeled from statistical findings and as such would incorporate a fairly large error. It should be pointed out that while a knowledge of relationships of input to output variables is essential to simulation, such knowledge does not have to be of a cause and effect nature. Correlative relationships can be as functional as cause and effect ones in predicting one variable from another. Thus, knowledge of the true nature of the intervening variables or mediating functions is not a requisite of adequate simulation. A black box approach is quite satisfactory as long as fairly reliable prediction can be made.

It should be understood when deciding the level of complexity of the simulation that any level of simulation is possible, assuming that the interactive relationships of the variables are known sufficiently well to develop functional models. The principal relevant constraint, however, is cost. When thinking about value functions, the researcher should not be unduly concerned with the availability of computing power, but rather with discovering reasonable things about which enough data or theory can be generated to effect them meaningfully. When costs are inserted, the process can be repeated to get the most meaningful simulation for dollars expended by eliminating successive layers of behavioral detail.

The first consideration in preparing for a simulation and in determining the level at which the simulation will operate is the establishment of criterion output variables. The primary purpose (but not the only purpose) of the instructional system is cognitive acquisition for which measures of student performance are usually utilized as evidence. A good operational measure of student performance is academic performance measured on standardized tests at periodic intervals, but this measure creates problems in the simulation attempts because test performance cannot be directly related to classroom teacher management activities. It is suggested here that the number of instructional units completed by students (individual and group) be adopted as the primary output variable.[6] This criterion should relate effectively to other measures of student overall cognitive gains because, in individualized instruction classrooms, it is assumed that completion of a unit

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[6] A similar variable, the total number of times students have been through each activity in the model, has been used by Cogswell, et al., op. cit., page 118.

of material is based on performance criteria, i.e., the student must demonstrate mastery of the material.

In addition to measures of performance which are related to cognitive acquisition, other output variables have importance to the goals of the classroom. Various indices of student and teacher satisfaction are important primarily because of the relationship between performance and satisfaction. Measures of pupil social attitudes can also have relevance since part of the school's job is to aid in the acculturation process. Also, variables concerned with career preparation, affect, and emotional stability could be examined. All of these variables, as well as many others, are important and should be considered to some extent in the preparation of the model in Phase II. However, to include these variables in the simulation would probably produce an extremely complex and, thus, extremely costly program. It is suggested, then, to limit the simulation of the role model to criterion variables which are concerned solely with cognitive acquisition of subject matter. Such a limitation should not be construed as an indication that other variables are considered to be unimportant.

Consequently, output of the simulation will be structured around the primary variable of the number of completed educational units or cycles. Output information will focus on:

1. Number of educational units completed by students (number of post-test assessments which students pass).

2. Summaries of the total time spent in various activities such as diagnosis, prescription, presentation, logistic activities, nonproductive activities broken down on the basis of the various patterns or allocations of activities.

3. Total time spent on activity as charged to students, teachers, aides (human and mechanical).

4. Numbers of students engaged in or requiring specific activities at any time, for example, number of students taking a post-test and number waiting to take a post-test.

As the model building progresses, additional output variables may be added and some of those currently listed may be deleted.

The inputs to the model are dictated by the variables required in the functions which predict the criterion variables. Many of the relationships will be explained (primarily in existing literature) during the early stages of model building in Phase II. Therefore, input variables suggested in this report should be considered only as being illustrative of such variables. Three basic sets of inputs to the model are given here. First, the instructional process will be specified as being composed of a finite number of functions (classes of activities) such as:

1. Diagnostic function.

2. Prescription function.

3. Goal-setting function.

4. Instructional function.

5. Evaluation function.

6. Motivation function, and possibly others.

Specific determination of these functions will be made on the basis of:

1. Analysis of Nova Complex information.

2. Analysis of other individualized models, particularly IPI,[7] PLAN,[8] and PRIME.[9]

3. Analysis of related research in education, psychology, management, etc.

Further information will be required on:

1. Conditions under which functions occur.

2. The ways in which functions combine to form an instructional cycle (for example, all functions probably will not be required to constitute a cycle but it would appear that evaluation must always occur).

3. Probable time duration (and range) of each function.

4. Basic requirements for performance of functions.

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[7]Robert Glaser, "The Program for Individually Prescribed Instruction." Paper read at AERA Annual Meeting, Chicago, 1966.

[8]John C. Flanagan, "Functional Education for the Seventies," Phi Delta Kappan, Vol. XXXIX, No. 27. (September, 1967.)

[9]Donald T. Tosti, "PRIME: A General Model for Instructional Systems," NSPI Journal, Vol. VII, No. 2. (February, 1968.)

5. A finite group of variations of activities within each function (for example, motivation may be provided in a number of ways) and the probable time ranges of these variations.

6. General conditions constituting a malfunction within any functions, including contingencies for interruptions.

The second set of input variables involve information on student characteristics. These include variables such as the following:

1. Variations in the number of students..

2. Classes of students on the basis of learning rate: slow, medium, fast.

3. Variations in numbers of courses being taken by students.

The final set of input variables is concerned with information on available resources and personnel, and will include:

1. Form and amounts of all media involved in information presentation.

2. Textbooks, video-tapes, movies.

3. Learning activity packages.

4. Programmed instruction textbooks.

5. Computer assisted instruction programs, etc.

6. Number, type, classification of available educational personnel.

7. Availability and capability of students as performers.

The major anticipated difficulty with simulating the model developed in Phase II is fulfilling Step No. 3 in Sasser and Naylor's procedural list—formulating the mathematical (or functional) relationships. However, much of the same information required merely to build the role model will provide the basis for functional relationships between variables. The prime method of obtaining such information is from the empirical literature which formulates relationships in meaningful and useful ways. It should be recognized, however, that all of the answers are not in the literature and that much of the information that does exist is countered by contradictory findings. Of course, if it was not believed that the job could be done, it would not be proposed. The simulation is predicted on the assumption that the information can be obtained; however, it will not be easy.

Summary

This chapter has attempted to draw a general picture of the possibilities of using computer simulation techniques to analyze various characteristics of the teacher's role. The purpose of such a simulation would be to analyze patterns and alternatives of role performance in an effort to give an initial validation of the model for individualized instruction (to be developed in Phase II) so that prototype training units may be developed more quickly and at less cost. This chapter included a discussion of the input and output information for the simulation.

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Chapter VII

CONCLUSIONS AND RECOMMENDATIONS

The Teacher's Role Project has as its ultimate objective the training of teachers for individualized classrooms. The training programs--which are to be developed in a projected future phase--are to be built upon an extensive theoretical and empirical base which includes the research reported in this document and a carefully constructed model of teachers' role behaviors which are optimum in the individualized classroom.

Phase I of the project has had as its basic purpose the study of the existing teaching system--particularly in individualized classes--in order that an adequate description could be made of that system. The descriptive data gathered in this phase attempted to cover all of the teacher's current role behaviors in the individualized classroom, with emphasis on the management characteristics of that role. In order to better describe the teacher in the individualized classroom, data were also collected on the other classes at Nova. These data provide a basis for comparison and better permit the identification of the behavioral patterns which are particularly unique to the individualized classroom teacher.

The project has not attempted to evaluate individualized instruction as a teaching approach. While adequate validation is necessary, the Teacher's Role Project has taken individualized instruction as a given. Whether an individualized approach is better or worse than some other instructional technique is not an issue in this study. The concern of the project has been only with the <u>role of the teacher</u> in an individualized environment. The success of an individualized approach is highly dependent upon the role behaviors of the teacher as well as upon many other facets of the educational environment. In a sense, an adequate evaluation of individualized instruction cannot be made until the technique itself is more perfected through projects such as the one described in this report.

A primary objective for the first phase has been to establish baseline data on which to build a model and against which to measure changes brought about by future in-service teacher training programs. The extensive gathering of data across the various teaching situations provides the baseline against which to measure future change. The data collected in the individualized situations--especially the classes using Learning Activity Packages (LAPs)--provide the baseline upon which the model of the teacher's role behaviors can be built.

Various comparisons were made across teaching situations and instructional divisions. Various characteristics which occurred most frequently in the LAP classes are identified and reported in Chapter IV. While the cause of these characteristics cannot be directly attributable to the structure and constraints imposed by the LAP, the LAP as an individualizing method is probably responsible for many of them.

In brief, the teacher who primarily uses LAPs is seen as spending considerable amounts of time with the non-instructional aspects of the classroom. Dorothy Myers was quoted in Chapter I of this report as saying that teachers spend many hours on activities which are not related to instruction such as the collection of milk money, monitoring hallways, and similar tasks.[1] While some of the tasks which she mentioned do occur, these particular tasks are not especially prominent. Rather, the LAP teacher is heavily involved with tasks which only indirectly relate to the learning activities in the classroom. The LAP teacher performs many logistical, maintenance, housekeeping, and traffic directing tasks which do not seem to require the talents of an educated professional. Yet in addition to these tasks, the LAP teacher is on demand to ask and answer questions, to make prescriptions and evaluations, and to give additional subject matter information when needed.

The LAP teacher as he was found in Nova (especially the High School), as Rosove has described the teacher in the individualized classroom, is less a dispenser of facts and more a facilitator or manager.[2] In Chapter IV, it was pointed out that 36% of the LAP teacher's time is spent in system related events, and 57% of the self-initiated events are spent in system related tasks. In a 60 minute class, the average teacher spends about 22 minutes on system tasks such as roll taking, getting materials, cleaning equipment, and similar chores. During that 60 minute period, only a few minutes are devoted to tasks which the teacher himself initiates; the rest are events initiated by the students or someone else in the system. Of these teacher-initiated events, about five out of eight are system events and about three out of eight are subject matter

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[1]Myers, op. cit.

[2]Rosove, op. cit.

events. Thus, the average LAP teacher does not plan and present subject matter to the students as does the Traditional teacher. Rather, he presents information only sparingly and then usually in response to a student's question (approximately two-thirds of the teacher's interactions with students are initiated by the student).

One of the tasks set forth in the project's original proposal was to provide for staff differentiation. While the staff differentiation will not be undertaken until the model building activities in the projected Phase II of the project, the description of the LAP teacher's activities strongly suggests that there is a need for role differentiation. The problem is not as simple as it may seem, because it may be that the teacher engages in menial tasks partly because there is not a great need for him to do something in the subject matter domain. For example, Teacher B, who was discussed in Chapter IV, found himself walking around the room <u>waiting</u> for questions. If the system tasks were taken away from Teacher B, he would have even less to do. Consequently, satisfactory role differentiation will require an adequate model of the teacher's role behaviors and will require training of the teacher to perform those behaviors. Otherwise, teachers like Teacher B will not be helped by role differentiation.

No data on student performance were collected during Phase I. The design problem of relating specific student performances to specific teacher management techniques is almost insurmountable. In one sense, it is futile to talk about improving teachers' management patterns in the absence of adequate criteria variables (i.e., the students' performances measured against the objectives of the school). On the other hand, it is probably useless to attempt to relate minute changes in student performance to the teachers' behaviors in the classroom. Information of that type is more readily obtained in experimental studies than in field studies. Further, the interest in the in-class aspects of student behavior are only meaningful when they can be related to long term performances--especially as predictors. Changes in student's performance <u>could</u> be related to the characteristic patterns of teacher management, but because adequate control would not be available, no causative relationships could be established in ex post facto field studies of the type just completed. Consequently, no attempt was made to collect student performance data beyond those variables dealing with student interactions and queueing.

The absence of student data related to teacher behaviors will present a slight constraint in the development of a model of the teacher's role in the projected Phase II. However, it is not feasible to collect such data in studies such as the one completed. A more adequate source is the wealth of experimental literature which has been compiled over the years in psychology, education, management, and the other behavioral sciences. While the literature is incomplete and often contradictory, it will provide a better base from which to build a model than would data which could be gathered in uncontrolled, ex post facto studies.

In Chapter I of this report, five basic premises are listed upon which the entire Teacher's Role Project (as originally proposed) was based. The first of these premises is that the system management characteristics of the teacher's role in an individualized instruction environment are significantly important aspects of his ro e. Extensive data have been collected on the system management characteristics and while not indicative of importance in terms of achieving the objectives of the classroom, it has been found that much of the teacher's time is taken up by system management behaviors.

The second general premise is that these management characteristics are amenable to a systematic analysis to determine their nature, distribution, and salient features. That this premise has been substantiated is evidenced by the successful completion of this phase.

The third premise is that the management characteristics can be taught to teachers through the use of systematically prepared in-service and pre-service training courses. During this phase, one in-service course, the Contingency Management Motivation Workshop, was prepared but no effort was made to implement this unit in an in-service or pre-service environment. This activity appropriately belongs in Phase II.

The fourth premise is that student performance can be predicted on the basis of the teacher's management performance. None of the data collected in this section of the effort bear directly upon this premise. Nor was it the intention of this particular phase to deal with this hypothesis. Techniques for dealing with this hypothesis must be worked out in later phases.

The fifth premise is that this analysis and development process would significantly contribute to the frequently discussed topic of teacher staff differentiation. This is distinctly possible but as noted above, role differentiation should await the development of the role model.

The data collected on the teacher in Phase I provides a good description of the Nova teacher and will provide the first crude approximation to a role model. Models can be built from reality or they can be structured completely in the abstract. When they pattern reality only, they include all of the inconsistencies, inadequacies, and follies of that reality. When they are divorced from reality, they reflect ideal situations and ideal circumstances and tend to ignore the constraints of everyday life. The approach to be used in the projected Phase II model building is to take the reality based model and to evolve it toward a more optimal structure, retaining where necessary the constraints of the reality model. The data are now available for the reality based model; the next step is to refine it extensively.

In the refining process, the data will have to be further examined and analyzed beyond that reported in this document. Teacher functions as they exist will be more clearly defined and developed and the sequences of activites comprising these functions will be identified more fully. At the present, the functions of the Nova teacher are structured by the observational instruments (especially RO_1) more than by the data per se.

Recommendations

The data compiled and analyzed in this phase of the study are intended to be the basis of further efforts. The design of a model for the systems management characteristics of the teacher in the individualized classroom is definitely in order. The data gathered in this project distinctly support the emphasis on a model which could be the building ground for the prototype training units. The data reported herein reemphasize the model and suggest expansion of its scope to include not only the systems management characteristics of the role of the teacher but all characteristics of the role. Further, the focus should be shifted from discussion in the singular (the role of the teacher) to discussion in the plural (the various roles of educational personnel in the individualized classroom of the future).

The emphasis must remain on these roles in an individualized classroom; and to design the most optimal model, the next phase of this project should make a concerted effort to analyze all extant theories and models of individualization for their commonalities and their idiosyncracies. Research in individualization at all possible levels should be scrutinized for its contributions to the development of the required model; but to control the amount of effort required, it is suggested that three models of individualized instruction be focused upon: The IPI Model, The PLAN Model, and The PRIME Model (see the discussion of these models in Chapter I). These models, based on practical and extensive research will probably contribute the most to the development of the required model of the teacher's role in individualized instruction.

The immediate testing of the prototype training unit, which was developed in this phase, is strongly recommended. The testing of this unit can give valuable information and insight into the nature of the in-service training process which will be followed later. The test should also lead to the validation of this unit for future widespread in-service and pre-service use. Certainly, the behaviors which make up this unit must be evaluated in terms of the models which will be developed in the next phase, and hopefully the bulk of the behaviors will prove to constitute significant sections of the model.

Throughout the development of the model, it is strongly recommended that the developers bear in mind certain aspects of the approach which has been suggested. The requirements for careful delineation and subdivision of functions within the teaching environment should remind the developers to be constantly mindful of the availability (current or potential) of the introduction of technological devices into the model. The potentiality for computer assistance in the areas of student evaluation and assignment should particularly be analyzed. Further, as functional units of the teacher's role are subdivided, they should be analyzed for the optimal amount of ecucation required to perform them. Data compiled and analyzed in this report graphically emphasize that significantly large units of the teacher's function are the most menial and trivial housekeeping and watchdogging activities. The model should attempt to eliminate these menial units whenever possible and when not possible, should attempt to cluster them in a manner in which they can be assigned to personnel with adequate and appropriate training. Master of Arts teachers should not clean facilities, monitor the hallways, check multiple choice tests, etc. Their skills should be used at a much higher level.

Awareness of the probable necessity for more sophisticated patterns of organization of personnel, and efforts to include such sophistication in the model building activities, are recommended. As more carefully delineated specialties are created in the school, concomitant organization patterns will be required to utilize them.

The analysis of organizational constraints which affect the Nova Schools and all ES'70 schools is recommended as a parallel activity to the model building. As much detail should be collected as possible (within organizational and financial constraints of the phase) to more effectively implement the in-service training units. It is specifically recommended that the organizational study currently being undertaken by Drs. Love and Steward of Nova University be included as a significant part of the efforts to analyze organizational constraints.

Computer simulation of the proposed model is also recommended as a useful method of validating various patterns of educational personnel functions. As pointed out in Chapter VI, the formulation of both the computer model and the problem statement should be done thoroughly enough to reduce the programming constraints and lead to an effective and highly fruitful simulation effort. This effort should contribute not only to the partial validation of the model but to the development of extensive objectives for the training of educational personnel for performance in an individualized classroom. It can lead to the development of the training units and can be the basis for their validation.

The primary recommendation the investigators wish to urge is the continuation of the general outline suggested in the first chapter of this report, which is the extensive systematic analysis of the role of the teacher--of all educational personnel--leading to a research based model for a new conception not only of the teacher, but of the education profession--one which can meet not only the needs of the future, but the needs of today and can provide the quality education needed in the American schools.